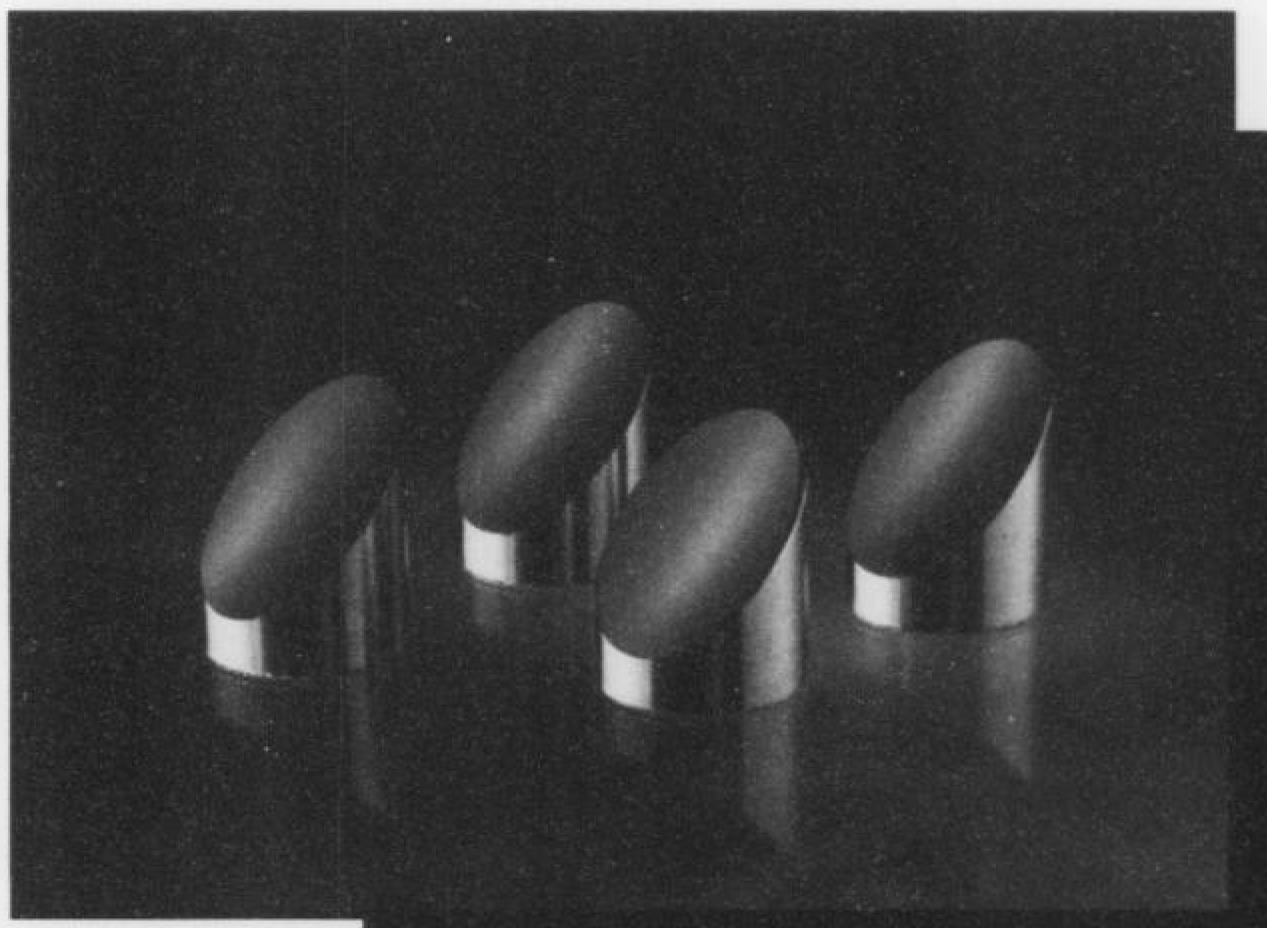
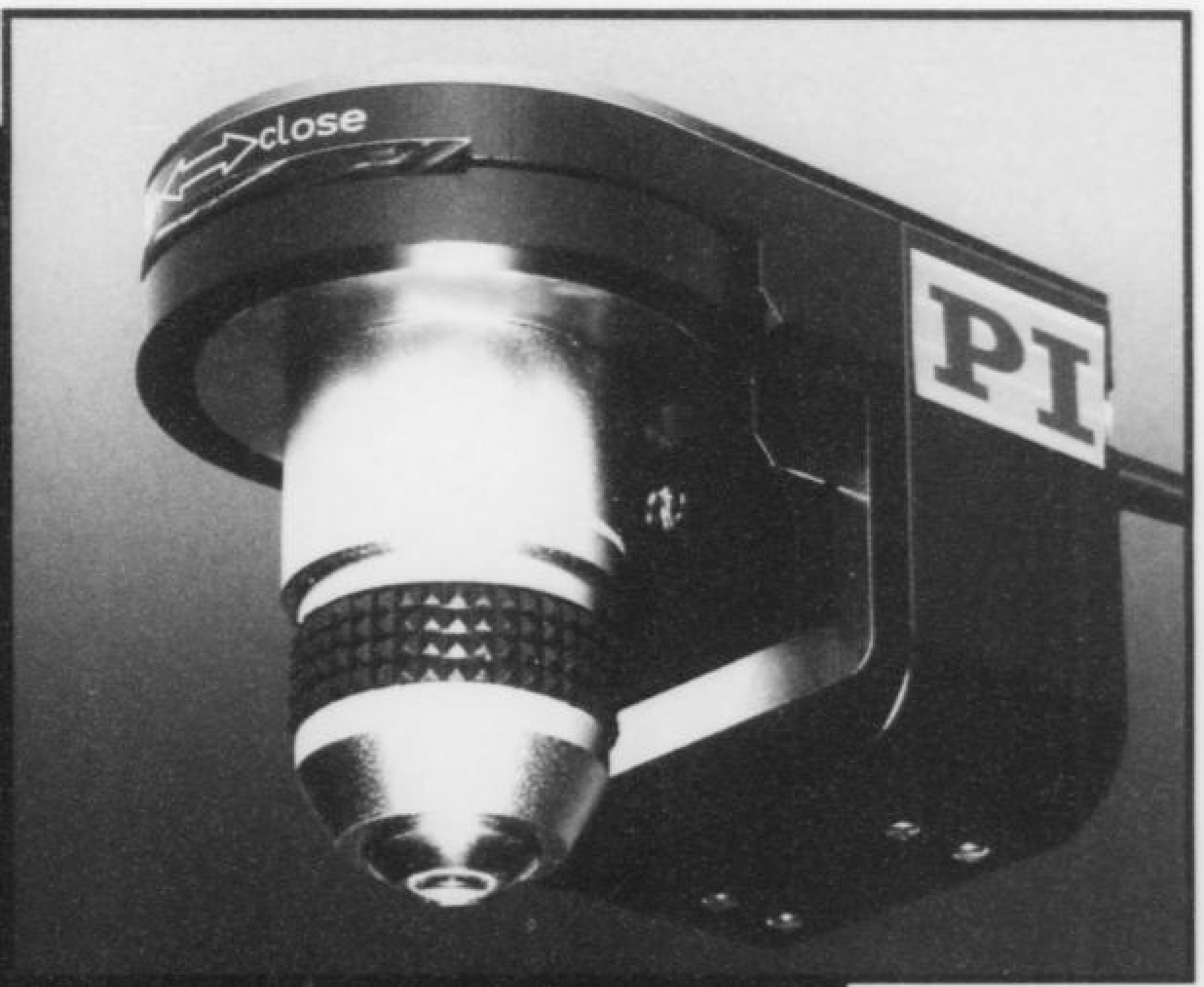
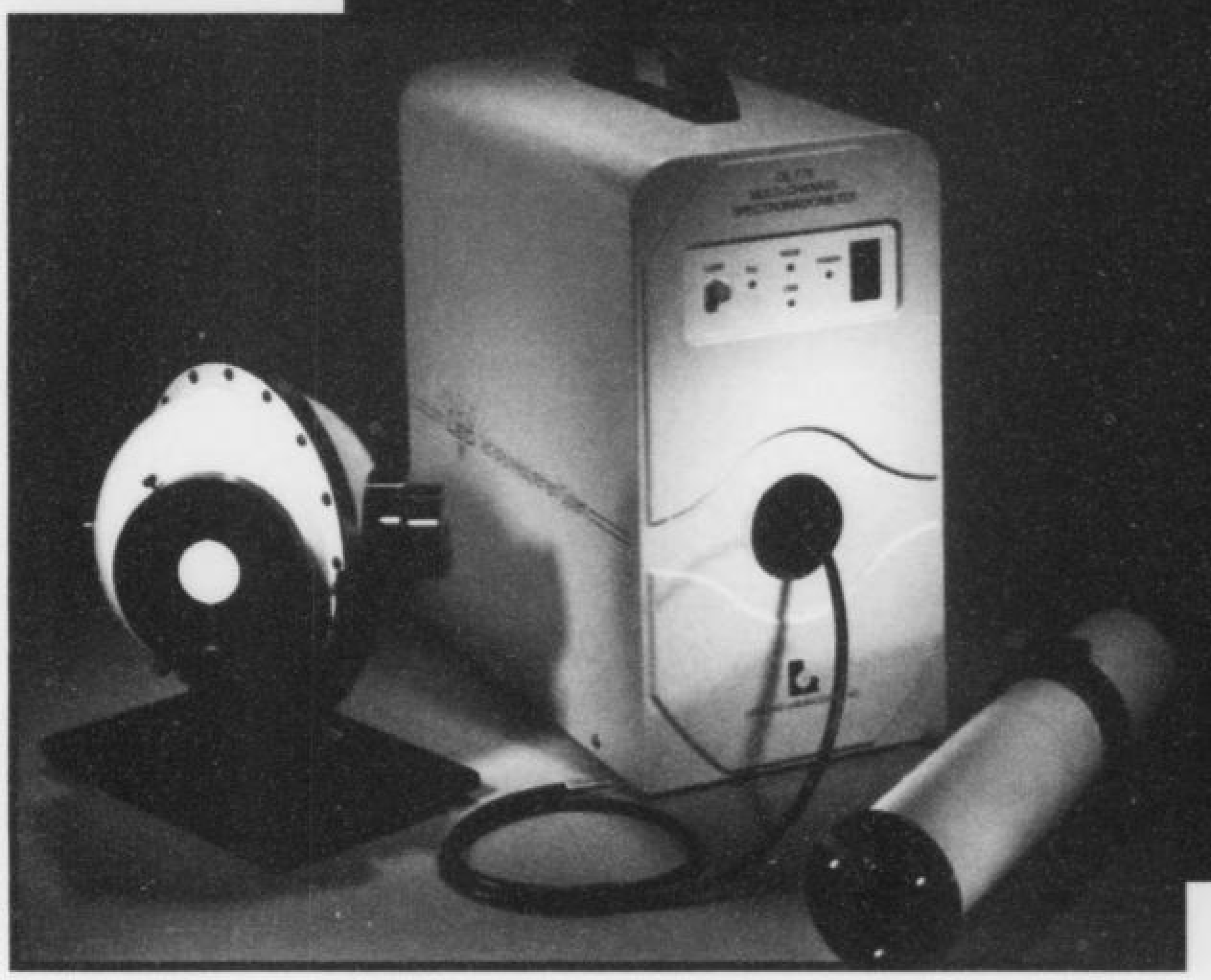
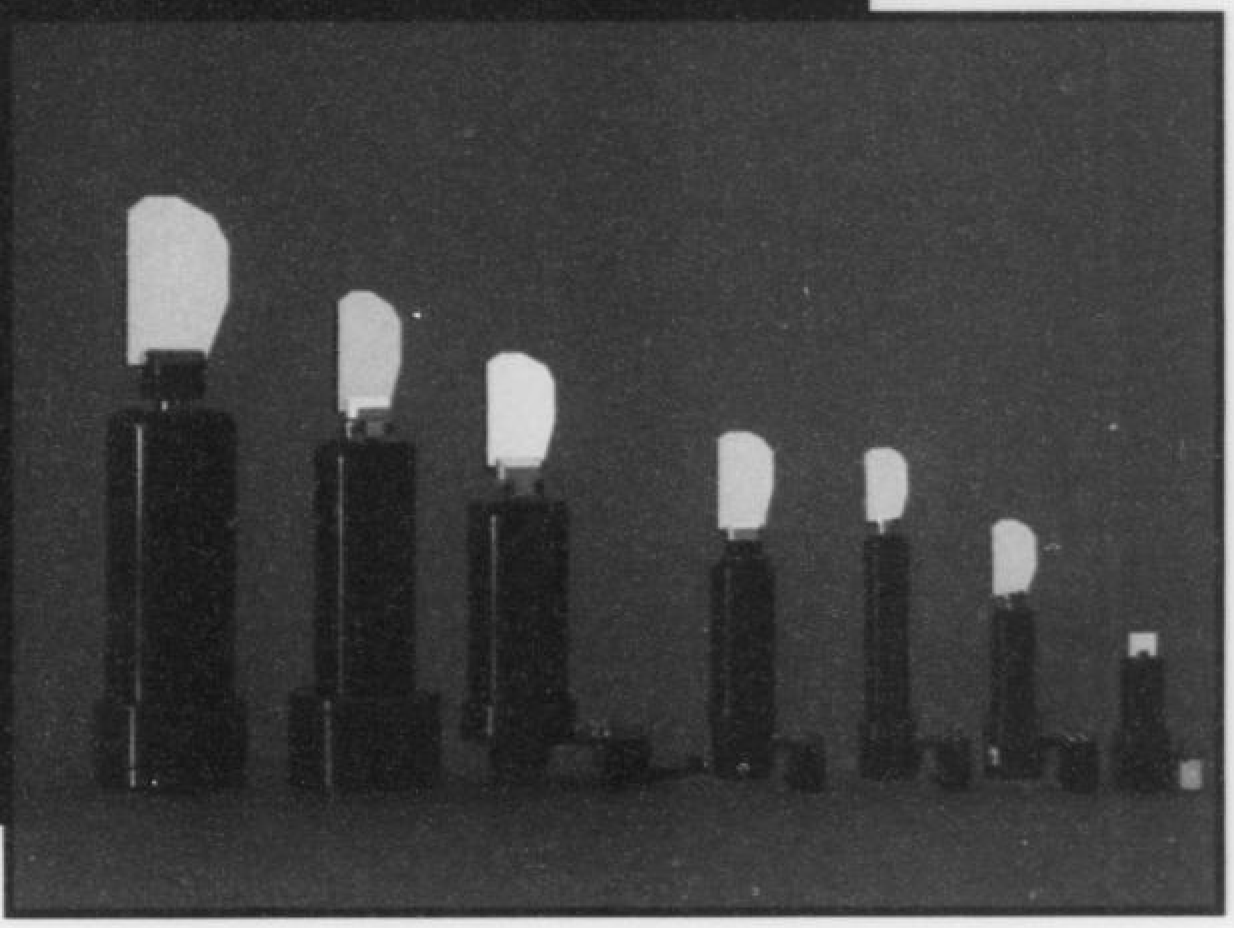
OPTICS, LASERS, IMAGING, FIBER OPTICS, ELECTRO-OPTICS, PHOTONIC COMPONENT MANUFACTURING

PHOTONICS SHOWCASE™









A GUIDE TO PRODUCTS, LITERATURE AND WEB SITES FROM THE PHOTONICS INDUSTRY

A Supplement to
PHOTONICS SPECTRA®

JANUARY
2005

FEATURES

Video Closes in on Coldness Response of Insects 5
by Caren Les
Using infrared video thermography, scientists have studied the ability of scorpion flies to adapt to subzero alpine temperatures.

Calendar Resource Guide 11

Tapered Fiber Provides NMR Sample Illumination 12
by Nancy D. Lamontagne
Optical fiber was etched to create a tapered illuminating fiber that scatters light uniformly inside an NMR tube.

Nanopositioning Stage Pulls Piconewtons in Molecular Stretching Application 17
by Stefan Vorndran, Physik Instrumente (PI) GmbH & Co. KG, Karlsruhe, Germany
A multiaxis closed-loop piezo stage can generate forces of piconewtons at subnanometer displacement resolution.

Advertiser Locator 22

PHOTONICS SHOWCASE
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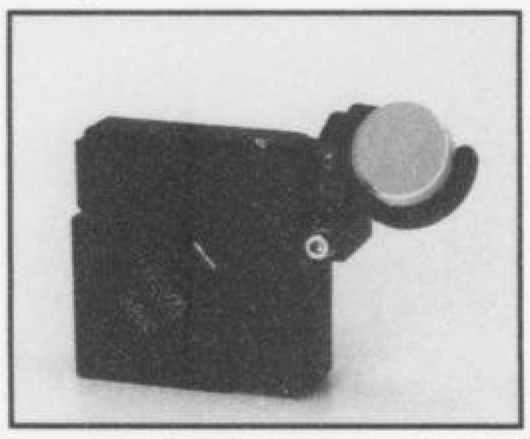
Photonic Products

Super Mount 8800: The Versatile Solution



Save money. Save room. Your most complex and compact beam-steering applications can be performed using the Model 8800 Super Mount from CVI. The Super Mount 8800 is a revolutionary mounting system with two axes of positioning — horizontal and vertical — and interchangeable optic holders. The 8800 system helps you build compact beam-steering experiments with a minimum number of optomechanical components. Don't settle for one axis of positioning when you can get horizontal, vertical, tip and tilt from one mount.

CVI Laser LLC **Circle No. 1**

DMD Discovery™ Technology Developer's Kit

The DMD Discovery 1100-DLP™ technology developer's kit is designed to enable non-projector applications of Texas Instruments' digital micromirror device (DMD). DMD Discovery products enable the system developer to load binary data into the DMD and create light patterns with high update rates. The products are flexible to facilitate exciting new products based on DLP technology. The kit includes an easy-to-use GUI with comprehensive data sheets and schematics.

Texas Instruments **Circle No. 2**

High-Current/BW Laser Diode Driver

WTC5
00803
WLD3343
000035224

Using Wavelength Electronics Inc.'s WLD3343 high-current, high-bandwidth laser diode driver in a master/slave configuration offers 9+ A at 2-MHz bandwidth (3 dB, constant current mode). The driver is ideal for high-power laser diodes, fiber-coupled pumps and bars. Complementary temperature controllers also are available. An applications note is available online.

Wavelength Electronics Inc. **Circle No. 3**

Luminance/Radiance Sources

SphereOptics-Hoffman introduces integrating sphere luminance/radiance light source systems for test and NIST-traceable calibration of electronic imaging devices, CCD arrays and multispectral cameras. Sphere sizes range from 15 cm to 2 m, each with an output port sized to provide uniform luminance of ±1% for accurate, repeatable measurements. Models with low-, mid- and high-radiance output levels accommodate applications in night vision, satellite imagery and quantum efficiency.

SphereOptics-Hoffman **Circle No. 4**

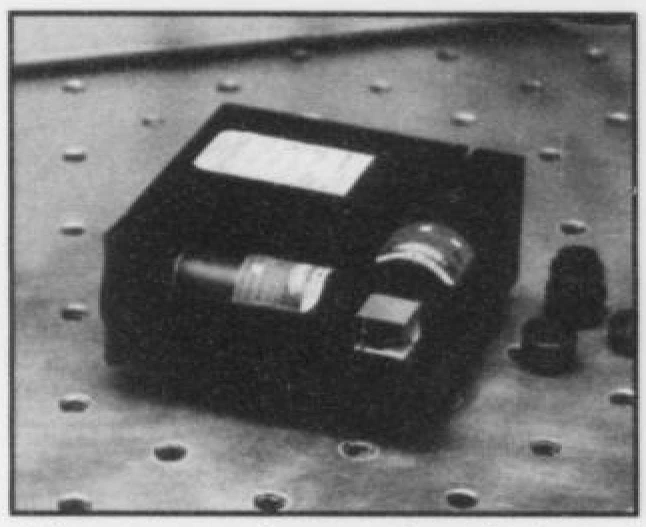
Photonic Products

Fluorescent Sealed Linears

Designed for use in industrial environments, StockerYale's SL series fluorescent fixtures are completely sealed to meet NEMA 12 specifications. Units are available in Twin 4-, Twin 6-, Twin 8- and Twin 13-W configurations. Lamps for all configurations are available in a wide variety of colors and color temperatures. Optional polarizers, diffusers and filters are available.

StockerYale Inc. **Circle No. 5**

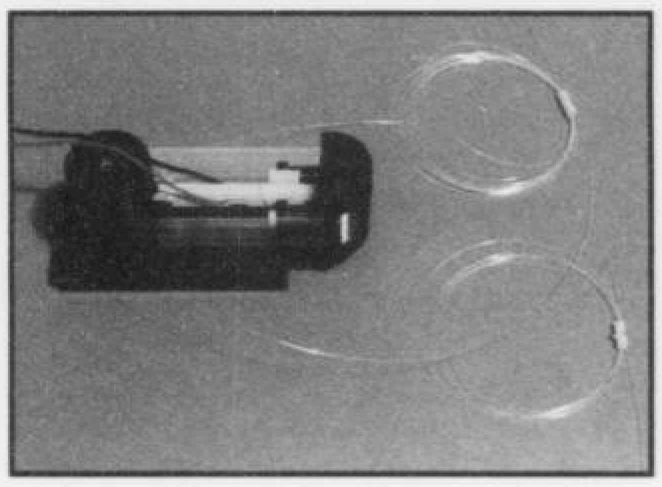
UV, Visible & IR Laser Diode Technology



Power Technology Inc. offers a variety of laser diode modules for analytical, biomedical and industrial applications. Available wavelengths extend from 370 to 1600 nm, with output powers from a single milliwatt to several watts. For applications requiring even more power, we offer a dual-beam combiner that not only can double the power available at a certain wavelength, but also can merge two wavelengths.

Power Technology Inc. **Circle No. 6**

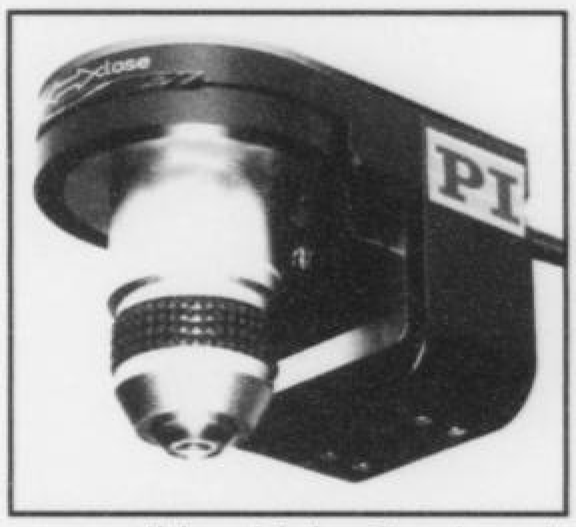
Piezoelectric Fiber Stretcher



Our fiber stretcher uses approximately 15 m of fiber to provide more than 4-mm stretch in most fiber types for optical coherence tomography fringe scanning and delay line applications. It is supplied with a high-voltage driver card and/or controller.

Canadian Instrumentation & Research Ltd.
Circle No. 7

Nanofocusing and Image-Dithering Stages



PI provides the fastest and highest-resolution nanofocusing and image-dithering piezo stages to enhance resolution in digital imaging and microscopy. The stages offer subnanometer resolution for positioning to fractions of a pixel, fast response to keep pace with high frame rates and very high repeatability. A variety of standard and OEM controllers are available. The stages are compatible with leading imaging software packages.

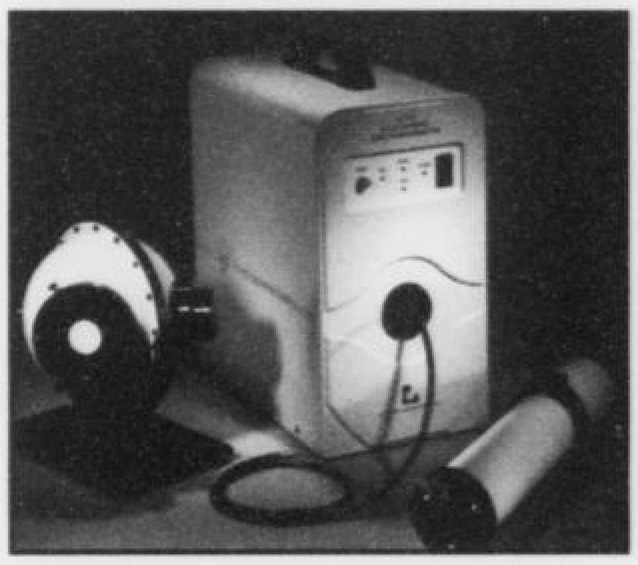
PI (Physik Instrumente) L.P. **Circle No. 8**

Galvanometer Series

The 6200H moving-magnet, closed-loop galvanometer series combines Cambridge Technology Inc.'s latest development in actuator technology with a patented advanced optical position detector design. The result is high torque per watt and closed-loop bandwidths for high positioning speed and accuracy.

Cambridge Technology Inc.
Circle No. 9

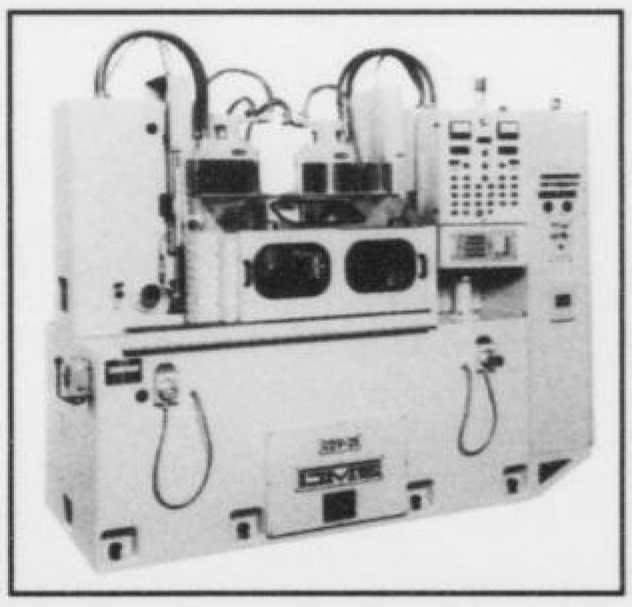
High-Speed LED Test and Measurement



The OL 770-LED high-speed spectroradiometer is optimized for LED test and measurement. Capable of more than 25 spectral scans per second, the OL 770-LED is a complete turnkey LED measurement system designed in accordance with CIE Publication 127, conditions A and B. It provides research-grade measurements at a fraction of the cost of bench-bound instruments, and is ideal when instrument portability is needed.

Optronic Laboratories Inc. **Circle No. 10**

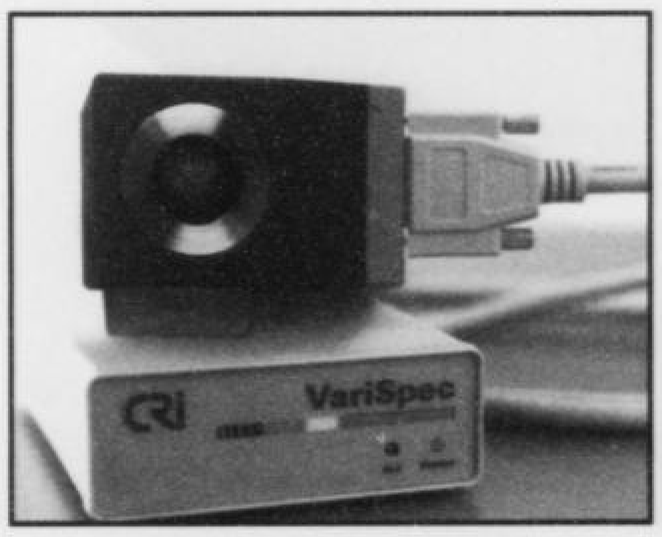
Precision Surface Grinders



Precision grinders from Mildex offer infinitely variable stepless infeeds, which are superior for grinding glass, ceramics or rare-earth materials. Chuck sizes from 10 to 60 in. are available, including twin-head models (shown) for further production efficiency. Continuous processing from rough to finish is possible in one chucking.

Mildex Inc. **Circle No. 11**

VariSpec™ Liquid Crystal Tunable Filters



Solid-state, imaging-quality VariSpec liquid crystal tunable filters from the industry leader enable effortless tuning to any wavelength in the VIS or the near-IR without vibration or noise. A USB interface provides digital control and power, as well as easy integration for your research or OEM applications. Windows software SDK is available.

CRI Inc. **Circle No. 12**

Photonic Products

Oriel MIR8025™ FT-Spectrometer

Newport's Oriel MIR8025 FT-Spectrometer was designed for versatility, performance and value. It is modular: The beamsplitter, detector and source are interchangeable so that you can build the system to your needs, with our components or your own. The MatLab®-based software with ActiveX™ control, and a USB 2.0 interface simplify operation and data collection. The device is suitable for R&D applications, such as laser diagnostics, fiber characterization and radiometry, and is used as a subassembly by systems integrators.

Newport Corporation **Circle No. 13**

Imaging and Capillary Fiber Optic Components

SCHOTT Fiber Optics manufactures high-resolution imaging fiber optic faceplates and tapers for demanding defense, medical and scientific applications. Additional offerings of flexible coherent imaging bundles, high-density capillary arrays, photonic crystal fibers and specialty hybrid components provide customization and flexibility for design versatility.

Fiber Optics, SCHOTT North America Inc. **Circle No. 14**

FireWire Laser Beam Profiler

Spiricon Inc. announces laser beam profilers that use FireWire-equipped cameras that connect directly to a laptop computer for portable beam analysis. Multiple FireWire cameras operate simultaneously and capture CW and pulsed laser beams. The LBA-FW uses standard megapizel CCDs for UV and visible lasers. Spiricon's Pyrocam III covers the IR from 1 to more than 1000 µm.

Spiricon Inc. **Circle No. 15**

Miniature CO_2/CO Laser

Access Laser Company is offering a new generation of RF-excited CO_2 and CO lasers operating from 9.2 to 11 µm and from 5.2 to 6.0 µm. They produce between 100 mW and 20 W of power and are available as wavelength-tunable, stabilized, superpulsed and Q-switched lasers. Also available are isotope CO_2 gas, high-speed-modulated and portable battery-operated versions. Applications include spectroscopy, optical fiber processing, surgery, and marking and coding.

Access Laser Co. **Circle No. 16**

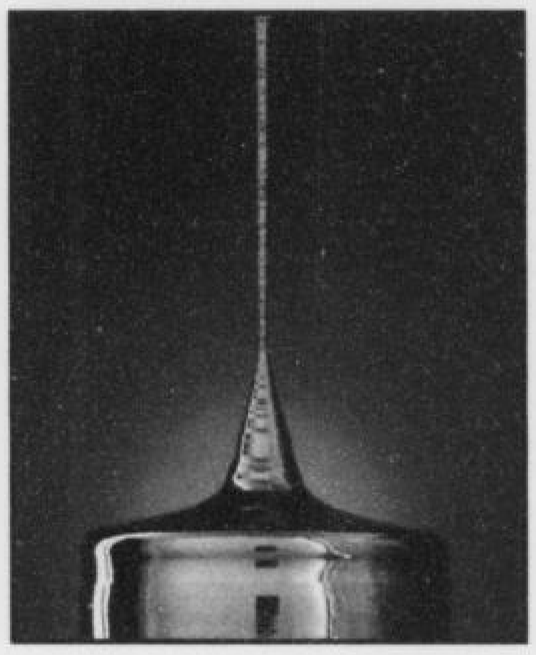
Silicon & InGaAs TTL Detectors

EOT
TTL & Analog
Silicon Detector
ET-2030TTL
Electro-Optics
Technology, Inc
sales@eotech.com
www.eotech.com
23-2007T

Electro-Optics Technology Inc. (EOT) introduces the ET-2030TTL and ET-3000TTL silicon and InGaAs photodetectors. These detectors provide both a digital TTL output for triggering applications and an analog output. They include an adjustable A/D threshold with external monitoring and pulse stretching for applications that require longer logic high durations.

Electro-Optics Technology Inc.
Circle No. 17

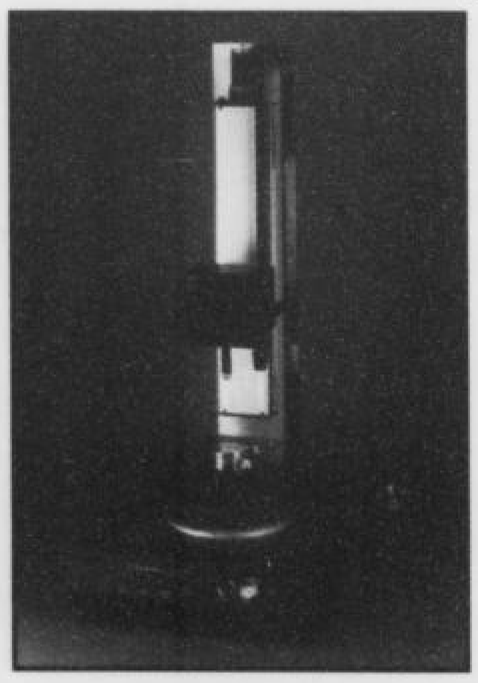
High-Quality Silicon for Optics



Lattice Materials is the world's leading supplier of silicon optical parts, including laser mirrors and infrared lens blanks. We set the standards for quick quote turnaround, fast and reliable delivery and finish quality. We can generate curved blanks, and we have extensive machining capability for complex parts.

Lattice Materials Corp. **Circle No. 18**

Precision Lens Alignment Station



The Laser Alignment and Assembly Station is a "must have" for those needing to precisely center multielement optical assemblies. A visible diode laser measures tilts as small as 0.5 µm TIR. It is ideal for cementing achromats (doublets, triplets and cylindrical), for potting subassemblies and for assembling entire lenses. And with the new CalcuLens™ software package, data collection and analysis is greatly enhanced.

Opto-Alignment Technology Inc.
Circle No. 19

Photon-Counting Photodetector Modules

electron tubes

DM0060C compact photon-counting photodetector modules are now available with an RS-232 interface. They are self-contained and require an external +5-V bias. Sensitive to a spectral response range from 280 to 850 nm, the instruments include the photomultiplier, a high-voltage power supply, an amplifier-discriminator, a microcontroller and Windows-compatible software. Two software-controlled output signals and a trigger input are provided for customer-specific applications.

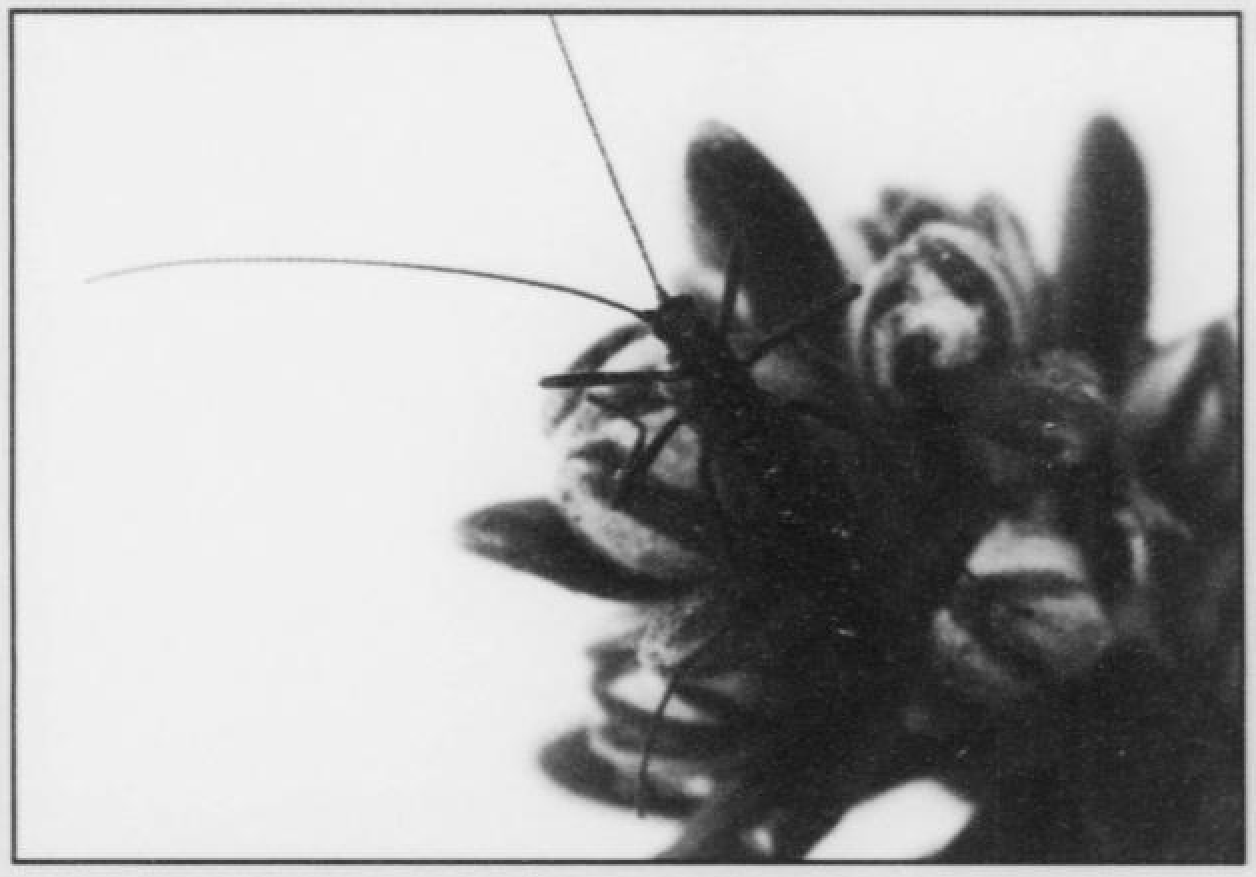
Electron Tubes Inc. **Circle No. 20**

Video Closes in on Coldness Response of Insects

by Caren B. Les

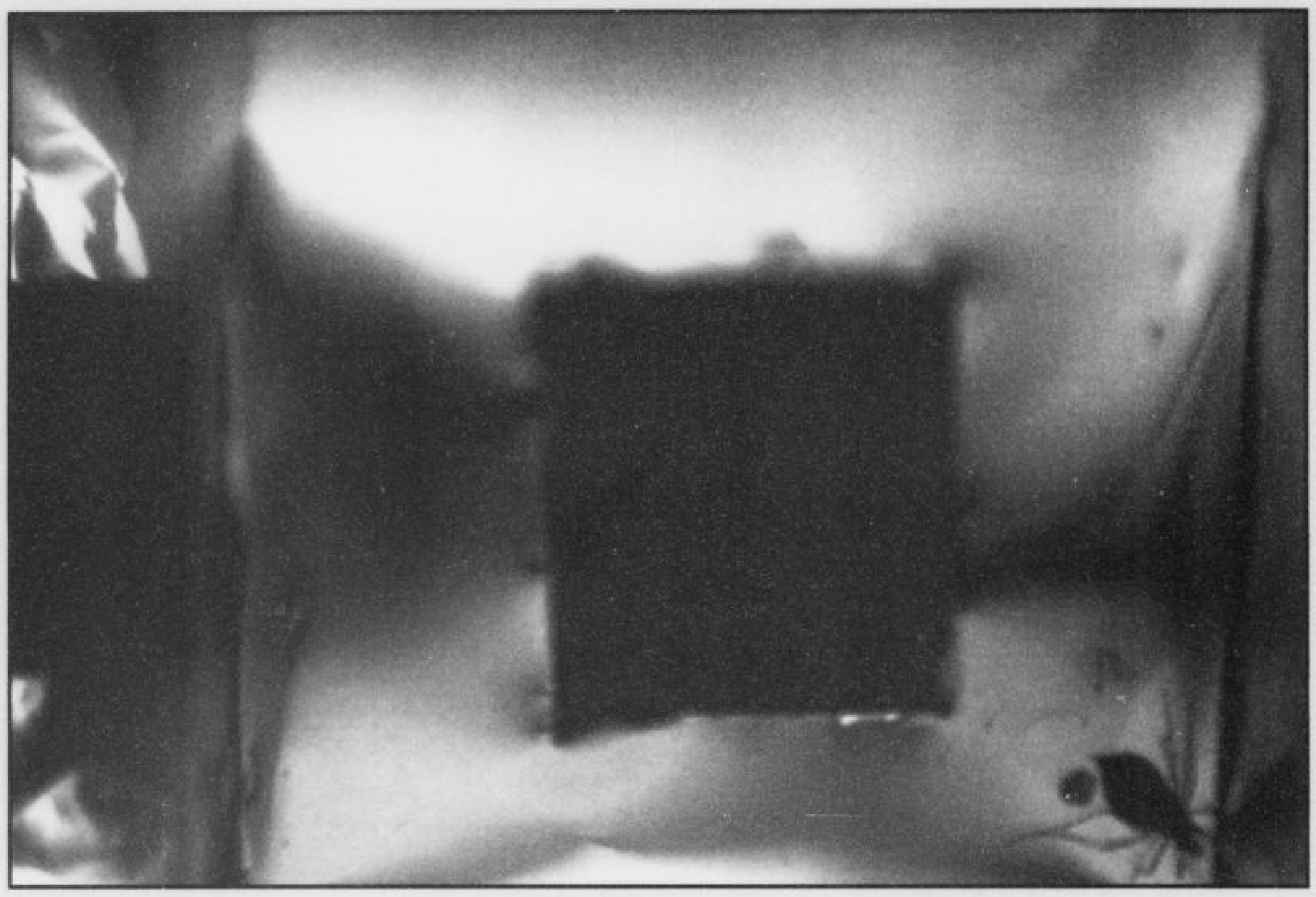
In the alpine areas of Mount Mawson, Tasmania, Australia, there exists a species of insect, *Apteropanorpa tasmanica* Carpenter, that embraces the cold and snow in a lively manner. Researchers at the Australian National University in Canberra have used an infrared video thermography technique to investigate these creatures, also known as scorpion flies. Adults of the species possess some form of tolerance and adaptation to subzero temperatures, and the technique enabled the scientists to view their behavioral response to temperature reductions.

As reported in the August 2004 issue of *BioTechniques*, they determined that the noninvasive video method, which incorporates the unhindered motion of the insect, is significant in that it takes into account behavioral characteristics that may contribute to adaptation. Other methods that have been used to study the physiological limits of insects to low temperatures, such as differential scanning colorimetry, temperature-controlled cooling apparatus, thermocouples and computer-controlled chart recording equipment, have required the animals to remain stationary.

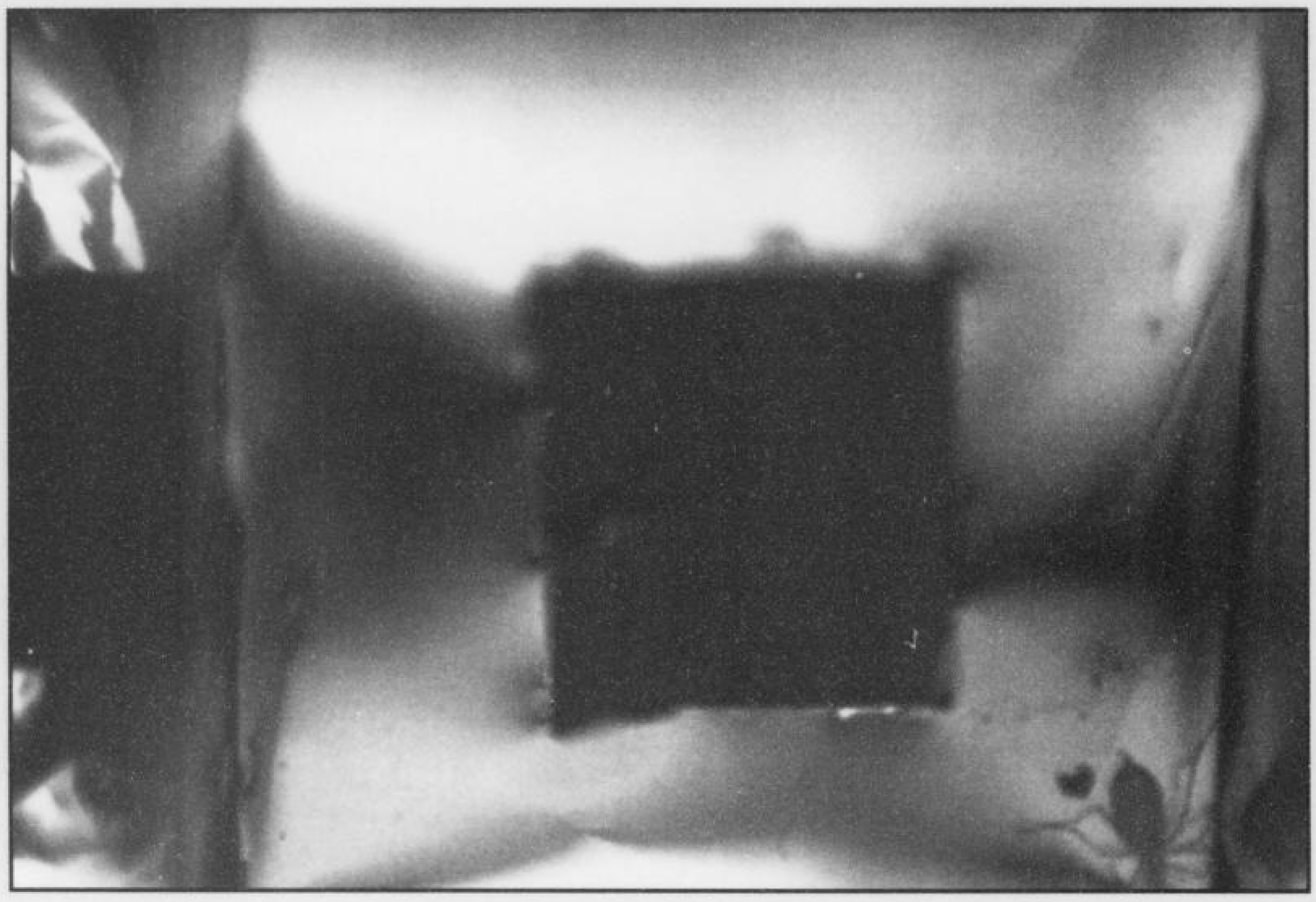


This adult Apteropanorpa tasmanica *male sits on the stem of the kerosine bush, a plant that grows in the Tasmanian alpine environment. The body of the insect, excluding the antennae, is about 8 mm long. The species belongs to the insect order Mecoptera, which includes scorpion flies.*

Alpine landscapes, such as this one in western Tasmania, Australia, are home to the A. tasmanica *species of insect. Researchers have used infrared video thermography to assess the insects' ability to inhabit the cold. Images courtesy of Christopher M. Palmer.*



This female is shown just before freezing, at a temperature of 26.7 °C. In the experiment, an infrared video camera was fitted to an insulated box, which functioned as a cooling chamber. The insect was contained in a rectangular aluminum cup with a square section of the bottom cut out to allow the insertion of two thermocouples to record air and ground temperature. The dark square in the picture is high-density foam that was used to close the hole.



In this image, it is evident that the female has started to freeze because it has changed color, indicating that a marked rise in temperature (exotherm) has begun. Its temperature is −2.1 °C.

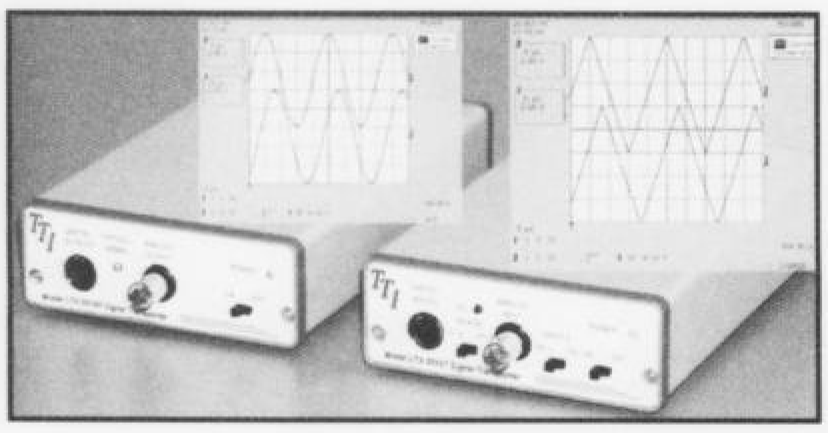
The researchers, directed by Christopher M. Palmer, collected 13 adult male scorpion flies from an alpine heath. They used a ThermaCam SC2000 infrared video camera from Flir Systems AB of Danderyd, Sweden, to assess the insects' response to decreasing temperatures. Sensitive to infrared radiation in wavelengths between 7.5 and 13.0 µm, the camera measures radiation intensity and then calculates and displays the object temperature in a false color image.

When the creature is about to freeze, exotherm occurs. This marked rise in temperature is caused by the release of heat as water changes from liquid to solid. The sudden temperature change appears as a corresponding color change on the infrared images.

The imaging technique provided physiological data such as supercooling points, lower lethal temperatures and hemolymph melting points. The information has greater biological significance because the insects were allowed relative freedom of movement during the experiment to more closely reflect their behavior in the natural world.

Regarding future research, Palmer said that it would be useful to test whether the insects' behavior has a significant effect on their physiological response to cold temperatures. □

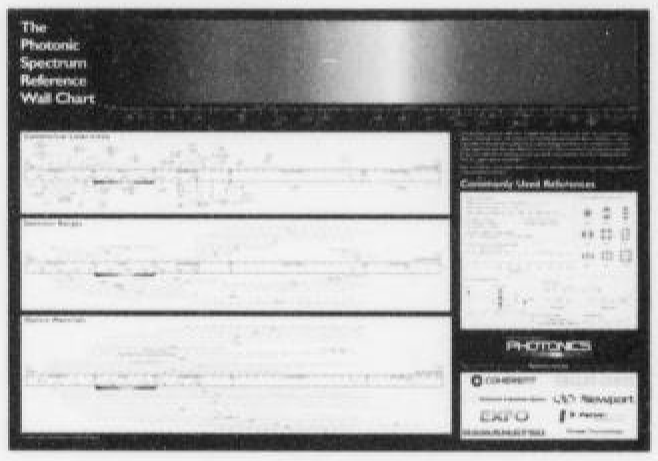
Precision E/O-O/E Converters



The new LTX-5510 Signal Transporter conveys a DC-12.5-MHz analog signal with 12-bit precision over single- or multimode optical fiber. Full-scale input ranges are selectable between ±1 and ±5 V, and the input impedance may be set to 50 Ω or 1 megohm. Multiplexed with the analog signal are four independent digital channels (TTL, CMOS, LVTTL) with switching rates up to 12 MHz.

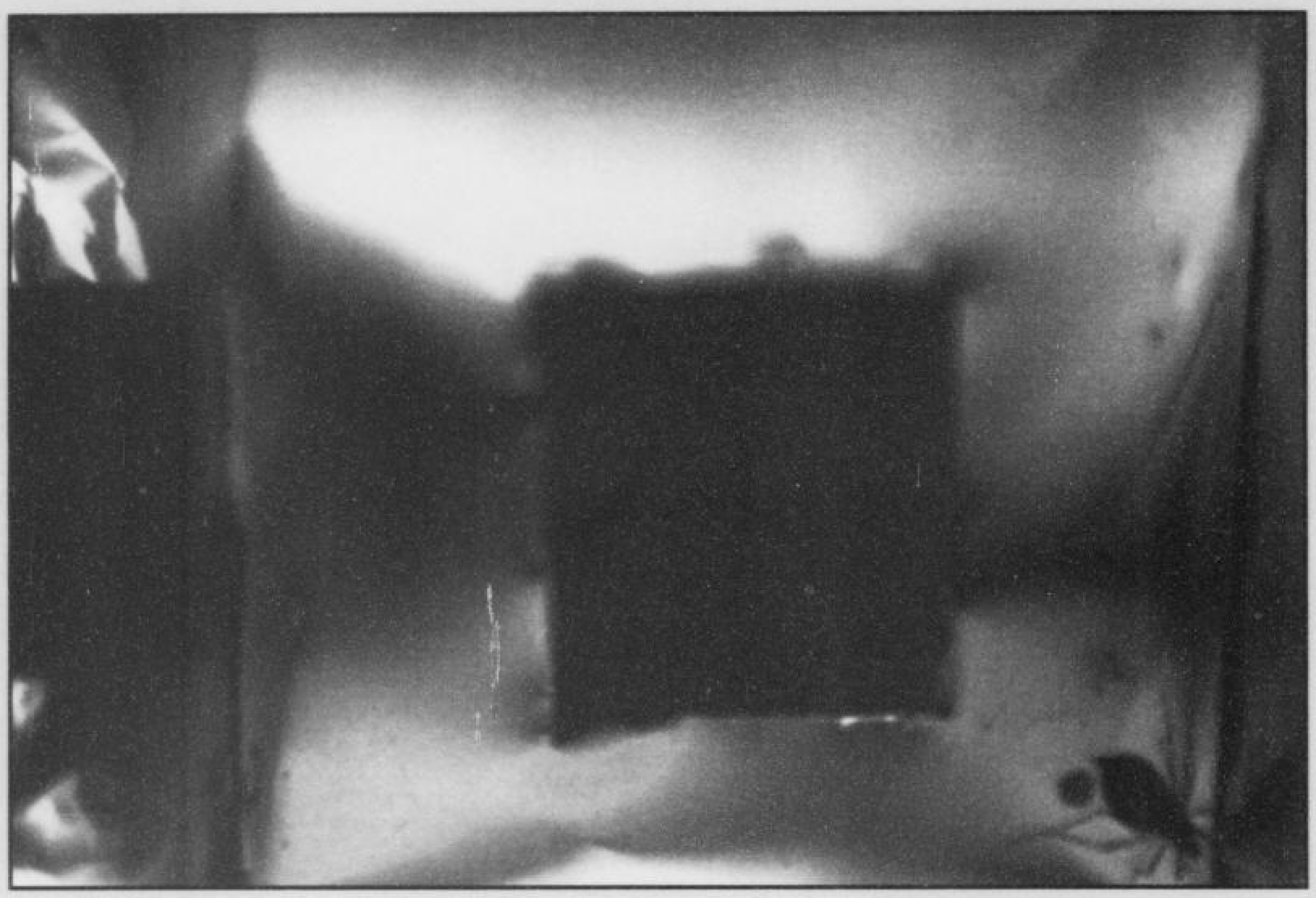
Terahertz Technologies Inc. **Circle No. 21**

Photonic Spectrum Wall Chart



The Photonic Spectrum Reference Wall Chart has updated information on commercial laser and detector lines operating between the UV and the far-IR. The 31½ × 21½-in. chart reflects developments in laser diodes as well as detector technologies. A new band shows the commonly applied transmission windows for many optical materials. The chart also has a reference section with conversion equations, lens formulas, electromagnetic modes and telecommunications data. To order, see card opposite page 8.

Photonic Spectrum Wall Chart



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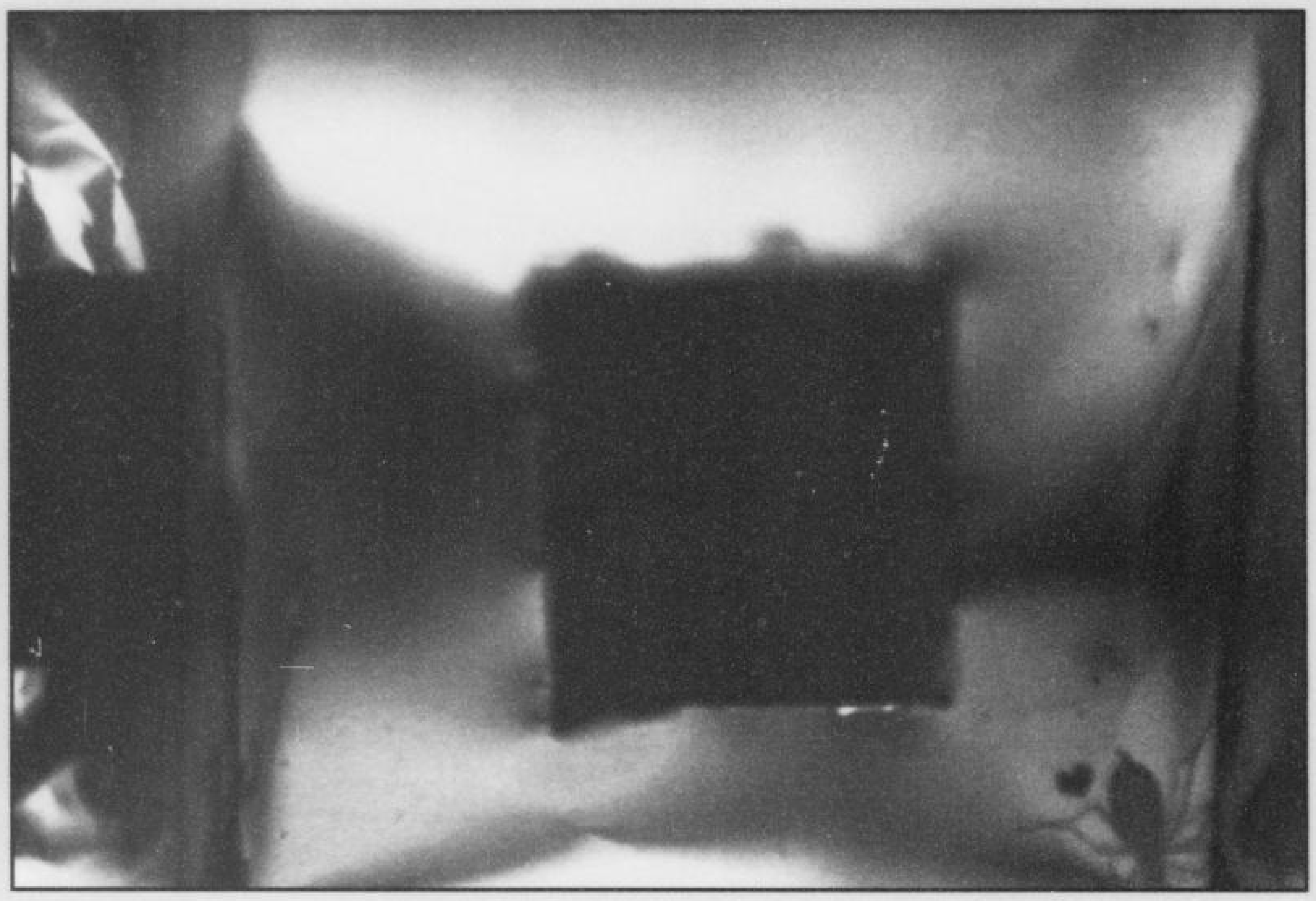

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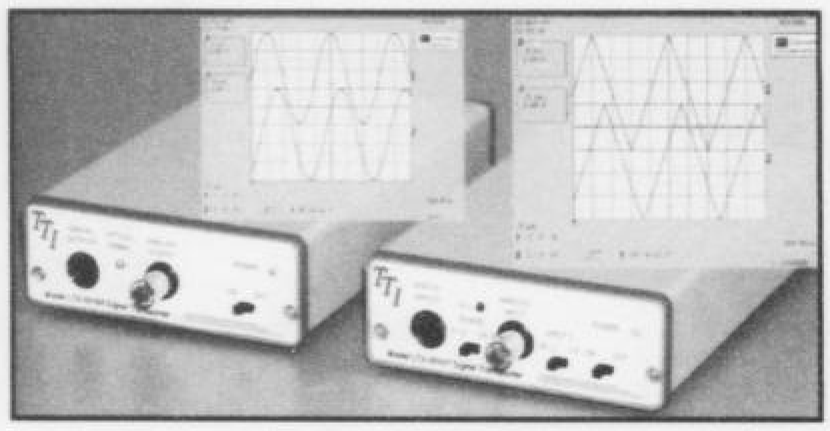

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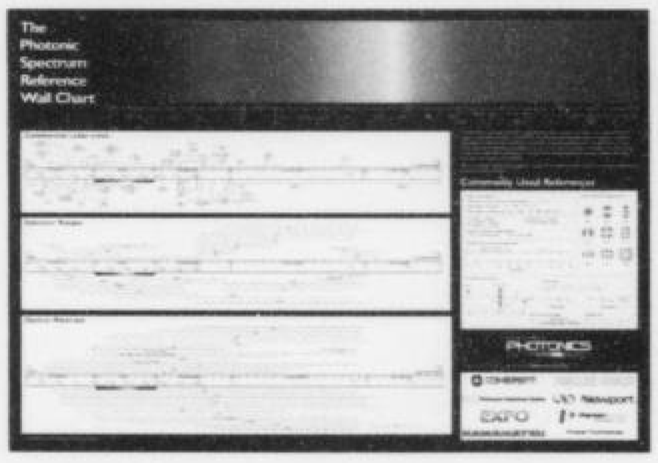
Terahertz Technologies Inc. **Circle No. 21**

Photonic Spectrum Wall Chart



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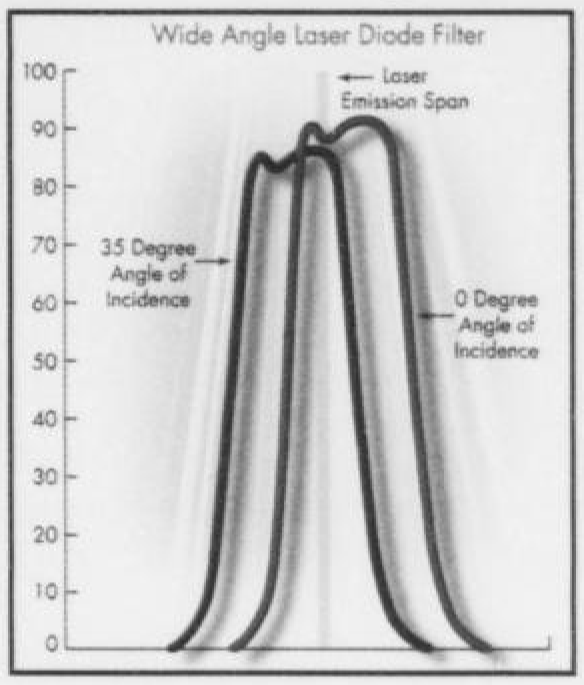
Photonic Spectrum Wall Chart

Photonic Products

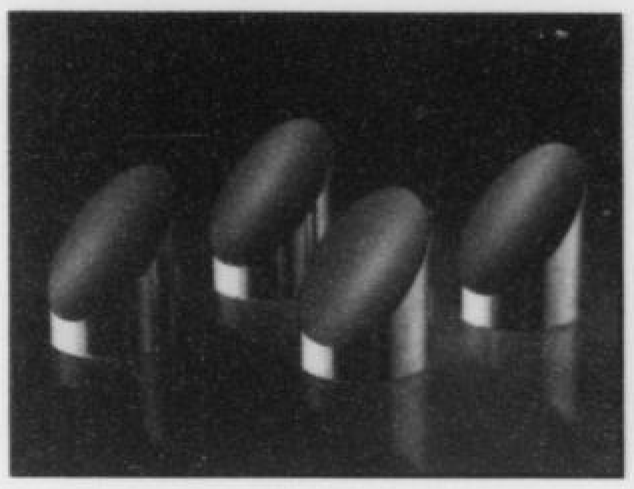
Laser Diode Signal-to-Noise Filters



SPECTRO-FILM stocks bandpass filters designed with 40-dB rejection outside of the bandpass area. Three types are available, with 0° to 15°, 0° to 25° and 0° to 35° angles of incidence. All are made from nonhydroscopic films for a life expectancy of 40 cycles MIL-STD-810C. Contact us for a hard copy, or download one from our Web site for our complete capabilities.

SPECTRO-FILM **Circle No. 22**

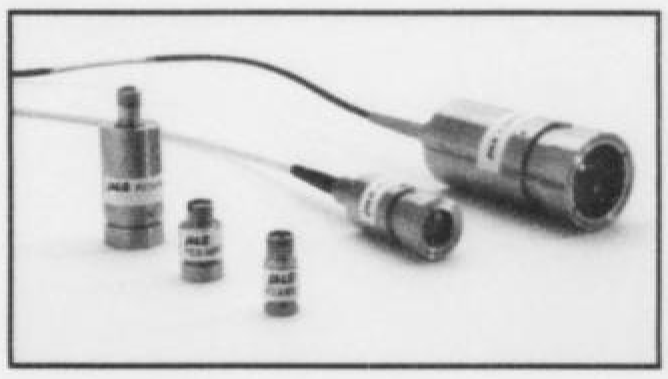
UV-VIS Metal Mirrors



Corning NetOptix announces its new LEC technology, allowing cost-effective production of diffraction-free aluminum diamond-turned mirrors without the need for nickel plating or polishing. The LEC process removes residual diffractive effects of the diamond-turning process without degrading mirror surface figure accuracy on aspheric, flat or free-form mirrors.

Corning NetOptix
Circle No. 23

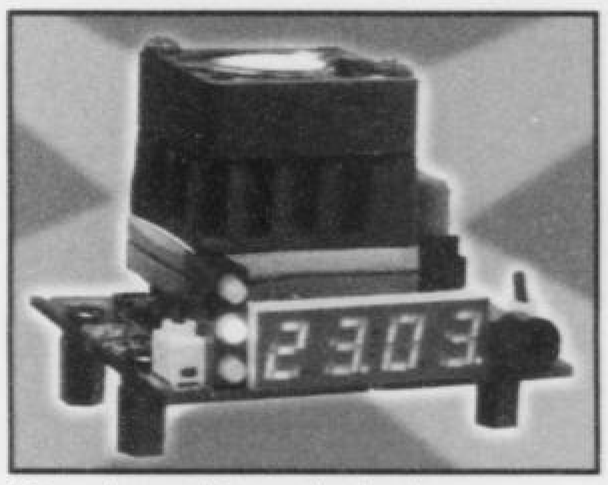
Fiber Collimators with Large Beams



Fiber optic collimators for single-mode and polarization-maintaining fibers have apertures from 5 to 45 mm and produce clean Gaussian beams that keep their shape over very long distances. Output has wavefront quality <λ/10 and adjustable focus/collimation, with a locking feature, for wavelengths from 370 to 1700 nm. Input has an FC or FC/APC receptacle. They are suitable for interferometry, remote sensing, free-space communications, large-object alignment, metrology and portable instrumentation.

Micro Laser Systems Inc. **Circle No. 24**

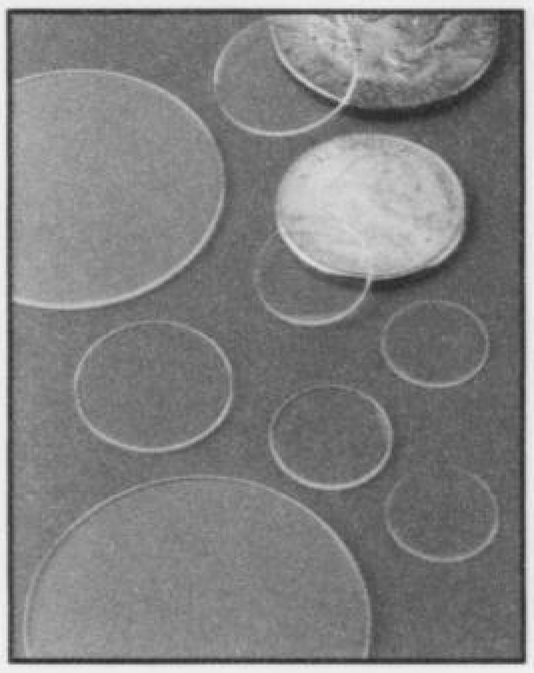
Simple Tool for Temperature Control



Based on the Wavelength Electronics WTC3243 temperature controller, this custom system displays temperature (converted from the thermistor signal), has an LED indicator tree to show "in" or "out" of range, and adapts to multiple thermoelectrics. Pricing is attractive for system integration as well as for research applications. As always, Wavelength's technical support team will help optimize your system to ensure your success.

Wavelength Electronics Inc. **Circle No. 25**

Sapphire Waveplates



Meller Optics sapphire waveplates for Er:YAG and holmium lasers extend polarization into the infrared and provide superior damage resistance to quartz and mica. They are available from 0.3 to 4.7 µm, and for Er:YAG and holmium lasers at 2.94 and 2.10 µm, respectively. The waveplates are offered in λ/4 and λ/2 versions and with diameters from 10 to 30 mm.

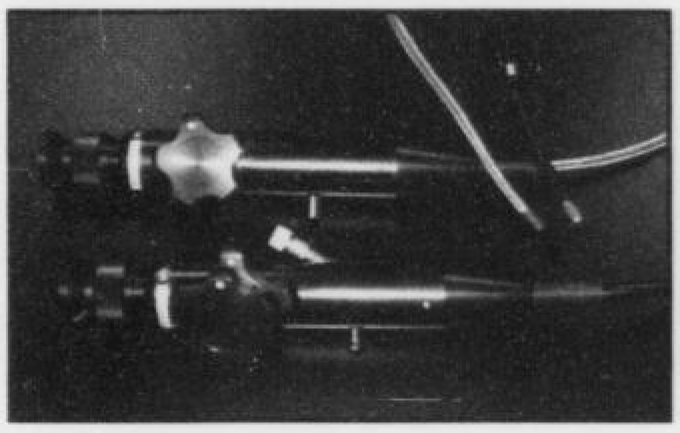
Meller Optics Inc. **Circle No. 26**

Large LED Dome Lights

Spectrum Illumination, the creator of Monster Light® technology, is pleased to introduce a series of large dome lights. All dome lights include our patent-pending DIN rail-mount LDM constant current driver and feature the highest-output LED light engines available in the vision industry. Three large sizes are available, with output areas of 12.25, 18.25 and 29.25 in.

Spectrum Illumination **Circle No. 27**

Copperhead Borescopes



Sunoptic Technologies is announcing the FS6 and FS8X40 Copperhead borescopes for quality assurance and preventive maintenance applications. Look around corners and into deep, dark recesses without the need for costly and time-consuming teardowns. High-grade optics produce very bright images, and our patent-pending Dura-Flex articulation system provides outstanding range of motion without the associated cost.

Sunoptic Technologies **Circle No. 28**

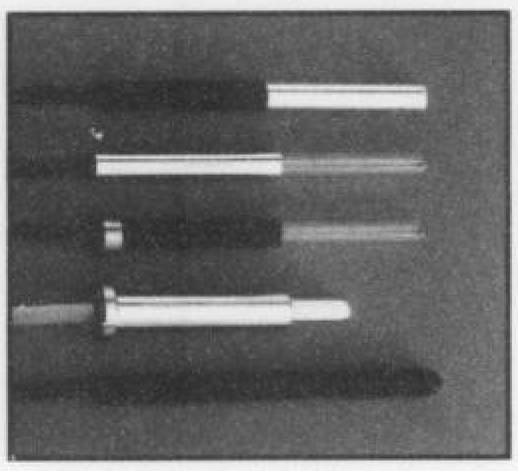
Microscope Objectives

Optics Technology Inc. designs, manufactures and assembles custom application microscope objectives and systems. Wavelength region spans from the deep-UV through the far-IR. The company offers rapid design and prototyping services and works with all optical glasses and crystals. Solutions are technically practical as well as cost-effective.

Optics Technology Inc. **Circle No. 29**

Photonic Products

Custom Light Sources for OEMs



Pen-Ray low-pressure UV lamps are offered in custom designs and quantity discounts, with testing, JIT, service and support. UVP has 70 years of UV technology experience. Products include mercury, zinc, cadmium and rare-gas lamps; custom-size mercury grid lamps; photochemical reaction and miniature 9-V battery-powered lamps; portable field packs; calibration and ozone-producing lamps; and power supplies. Applications include photochemistry, wavelength calibration and ozone cleaning.

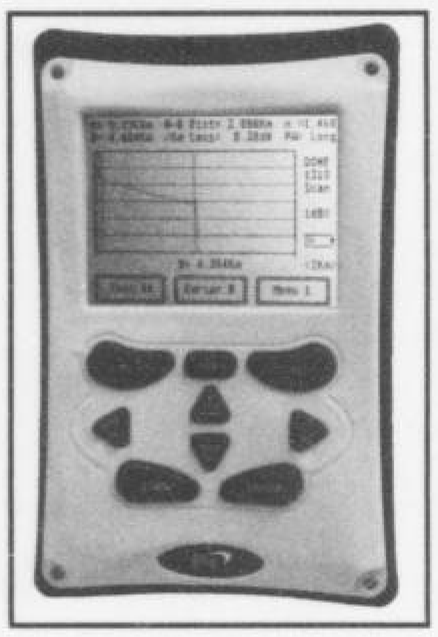
UVP Inc. **Circle No. 30**

Find-R-Scope Thermal Viewer/Camera

The Find-R-Scope thermal viewer is a lightweight, compact, handheld solid-state viewfinder. Ideal for surveillance, search and rescue, fire fighting, building inspection, industrial process control or monitoring, and military applications, it features long battery life, single-switch operation, 7- to 14-μm viewing and RS-170 video out. All viewer functions can be optimized through the optional RS-232/RS-485 serial interface and stored in nonvolatile memory for portable use.

FJW Optical Systems **Circle No. 31**

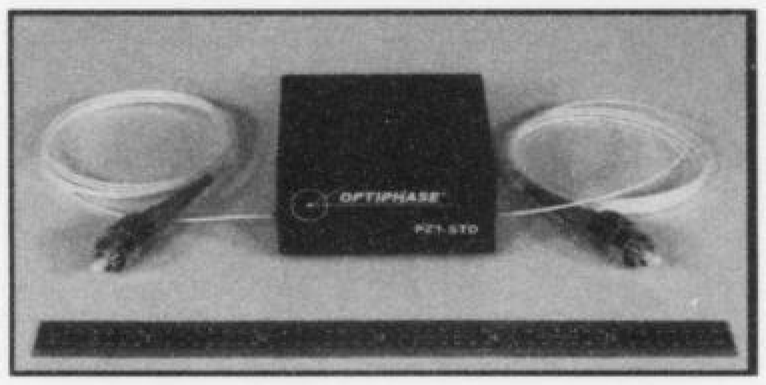
Certification Mini-OTDR



The Certification Mini-OTDR from Fiber Instrument Sales Inc. (FIS) measures only 7.1 × 4.6 × 3 in. The unit tests at four wavelengths: 850, 1300, 1490 and 1550 nm, three of which are common to FTTx applications. It interfaces with a PC and a printer to produce printed and electronic certifications. Metro/LAN versions are available. FIS carries a full line of test equipment, including power meters, light sources, fault locators and microscopes. Call for a free 2005 Communication Fiber Optics catalog.

FIS **Circle No. 32**

Fiber Optic Phase Modulator



The PZ1-STD is a cost-effective fiber-wound piezoelectric optical phase modulator that is suitable for a wide variety of fiber interferometric applications. Our multilayer winding approach produces an enhanced modulation function while maintaining a high operational frequency. Its compact package is ideal for small spaces. Please contact us for full details.

Optiphase Inc. **Circle No. 33**

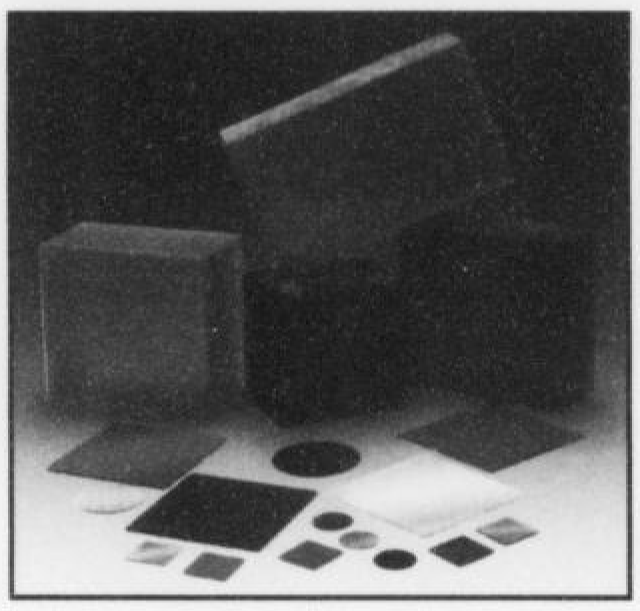
NIR-VIS Color-Corrected Hyperspectral Lenses

COASTAL OPTICAL SYSTEMS

Color-corrected from 400 to 1700 nm, the CoastalOpt™ hyperspectral 25-mm lens allows simultaneous imaging of visible and NIR wavelengths. The lens design complements Indigo Systems' new VisGaAs sensor by providing focus over the entire sensitivity of the sensor. The C-mount adjustable aperture lens accommodates 25.5-mm threaded filters and is available from stock. Custom configurations are available.

Coastal Optical Systems **Circle No. 34**

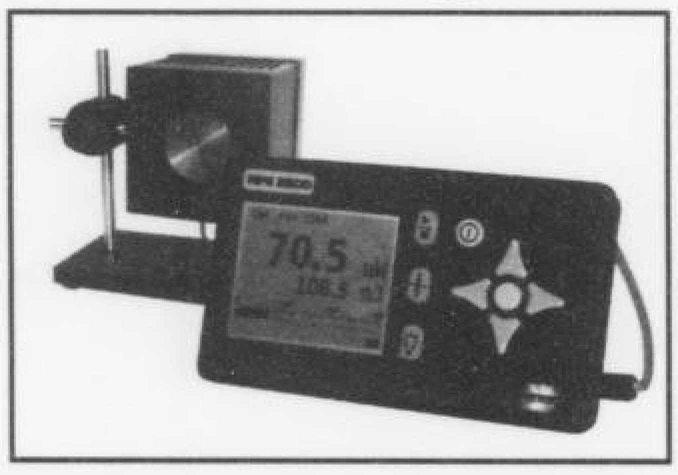
Color Glass Filters



Optima supplies a wide range of 127 filter glasses with optical wavelengths from 200 to 1100 nm. Product offerings include the following filters: low-pass, infrared, ultraviolet, heat-absorption and neutral. Other products include polarizers from 400 to 2000 nm, wave plates from 441.9 to 1550 nm and ball lenses. A complete product guide is available on our Web site.

Optima Inc.
Circle No. 35

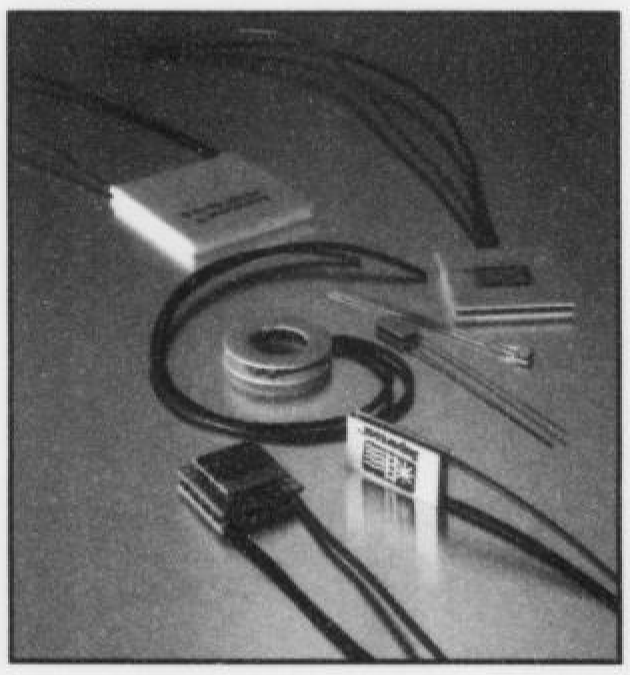
Power and Energy Meter



Spiricon Power Products Inc. announces a new universal, portable, dual-channel power and energy meter. It interfaces to thermopile, pyroelectric, semiconductor and temperature probes, and it features a digital readout, analog bar and dynamic graphs. Interfaces include an SD card slot and USB connectivity to LabView on Windows, Mac and Linux.

Spiricon Power Products Inc. **Circle No. 36**

High-Performance Thermoelectric Modules



Thanks to superior material characteristics and special production processes, we provide a variety of truly outstanding thermoelectric modules, comprising not only high-temperature and sealed modules, but also thermal cycling and multi-stage versions. We also offer the world's most extensive selection of off-the-shelf thermoelectric assemblies.

Supercool US Inc. **Circle No. 37**

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F. other engineering or science function (please specify)__________

Management Related
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H. technical
J. production & manufacturing
K. purchasing
L. other management function (please specify)__________

Other
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N. educator
P. other functions (please specify) __________

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J. consumer electronics & appliances
K. electronics, semiconductors and IC
L. electro-optical components, detectors, sensors and cameras
M. environmental monitoring
N. federally funded laboratory (military or civilian)
P. fiber optic components or systems
Q. hospital/medical university or office
R. industrial control systems and robotics
S. lasers/laser systems
T. manufacturing equipment, machinery or metal products
U. medical and biotechnology equipment
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The Photonic Spectrum Reference Wall Chart

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In our latest iteration of the Photonic Spectrum Reference Wall Chart, we updated information on commercial laser and detector lines operating between the UV and far-IR. The chart reflects recent developments in laser diodes as well as new detector technologies. A new band shows the commonly applied transmission windows for many optical materials. The chart also includes a reference section with conversion equations, lens formulas, electromagnetic modes and telecommunications data.

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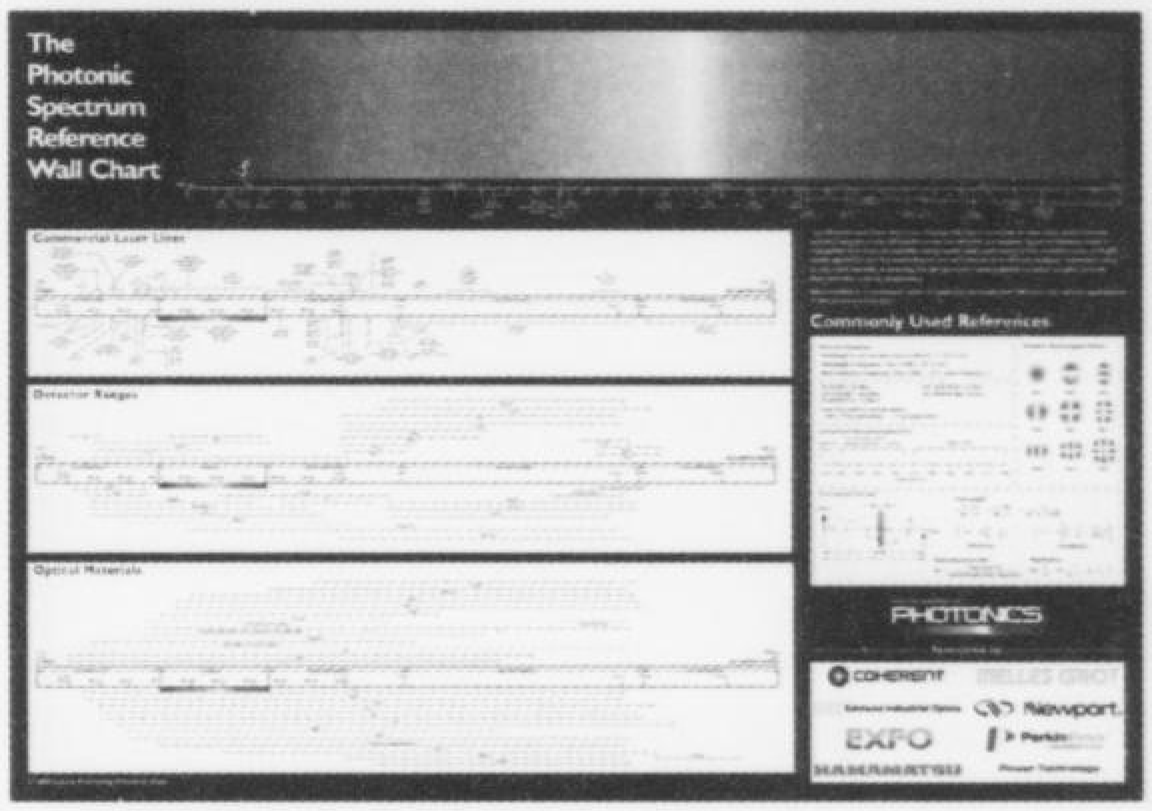

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B. design
C. application
D. production and manufacturing
E. measurement (testing, quality control or safety)
F. other engineering or science function (please specify)__________

Management Related
G. corporate
H. technical
J. production & manufacturing
K. purchasing
L. other management function (please specify)__________

Other
M. consultant
N. educator
P. other functions (please specify) __________

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R. industrial control systems and robotics
S. lasers/laser systems
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Calendar Resource Guide

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13th Annual AIA Business Conference Feb. 2-4 (Orlando, Fla.). Contact Automated Imaging Association, +1 (734) 994-6088 or +1 (800) 994-6099; fax: +1 (734) 994-3338; e-mail: aia@automated-imaging.org.

Advanced Optical Design Using Zemax Course Feb. 7-11 (San Diego). Contact Andrew Locke, Zemax Development Corp., +1 (858) 490-2840; fax: +1 (858) 490-2836; e-mail: andrew@zemax.com.

Biophysical Society 49th Annual Meeting Feb. 12-16 (Long Beach, Calif.). Contact Biophysical Society, +1 (301) 634-7114; fax: +1 (301) 634-7133; e-mail: society@biophysics.org; Web: www.biophysics.org.

Medical Imaging 2005, SPIE International Symposium Feb. 13-18 (San Diego). Contact SPIE, +1 (360) 676-3290; fax: +1 (360) 647-1445; e-mail: spie@spie.org.

Southcon/2005 Feb. 16-17 (Orlando, Fla.). Contact Sue Kingston, +1 (310) 937-1006; fax: +1 (813) 996-4460; e-mail: skingston@adelphia.net; Web: www.southcon.org.

AAFS 57th Annual Meeting Feb. 21-26 (New Orleans). Contact American Academy of Forensic Sciences, +1 (719) 636-1100; fax: +1 (719) 636-1993; Web: www.aafs.com.

APEX, IPC Printed Circuits Expo, Designers Summit Feb. 22-24 (Anaheim, Calif.). Contact IPC-Association Connecting Electronic Industries, +1 (847) 615-7100; fax: +1 (847) 615-7105; e-mail: shows@ipc.org; Web: www.ipc.org.

PITTCON 2005 Feb. 27-March 4 (Orlando, Fla.). Contact Pittsburgh Conference, +1 (412) 825-3220 or +1 (800) 825-3221; fax: +1 (412) 825-3224; Web: www.pittcon.org.

Phosphor Global Summit 2005 Feb. 28-March 2 (San Diego). Contact Stephanie Edwards, Conference Director, Intertech Corp., +1 (207) 781-2150; fax: +1 (207) 781-2150; e-mail: sedwards@intertechusa.com.

Microlithography: 30th SPIE International Symposium Feb. 28-March 4 (San Jose, Calif.). Contact SPIE, +1 (360) 676-3290; fax: +1 (360) 647-1445; e-mail: spie@spie.org.

MARCH

Advanced Laser Safety Officer Course March 1-3 (Las Vegas). Contact Leah Cridlin, Rockwell Laser Industries Inc., +1 (800) 945-2737; fax: +1 (513) 271-1598; e-mail: training@rli.com; Web: www.rli.com.

OFC/NFOEC 2005 March 6-11 (Anaheim, Calif.). Contact Optical Society of America, +1 (202) 416-1975; fax: +1 (202) 416-6140; e-mail: info@ofcconference.org.

Smart Structures and Materials/Nondestructive Evaluation for Health Monitoring and Diagnostics Symposiums March 7-10 (San Diego). Contact SPIE, +1 (360) 676-3290; fax: +1 (360) 647-1445; e-mail: spie@spie.org; Web: spie.org.

International Laser Safety Conference (ILSC) 2005 March 7-10 (Marina del Rey, Calif.). Contact Laser Institute of America, +1 (407) 380-1553 or +1 (800) 345-2737; fax: +1 (407) 380-5588; Web: www.laserinstitute.org.

Illumination and Stray Light Analysis Using Zemax Course March 7-11 (San Diego). Contact Andrew Locke, Zemax Development Corp., +1 (858) 490-2840; fax: +1 (858) 490-2836; e-mail: andrew@zemax.com; Web: www.zemax.com.

Workshop on FRET Microscopy March 8-12 (Charlottesville, Va.). Contact Ammasi Periasamy, Keck Center for Cellular Imaging, University of Virginia, +1 (434) 243-7602; fax: +1 (434) 982-5210; e-mail: ap3t@virginia.edu; Web: www.kcci.virginia.edu.

IMAPS International Conference on Device Packaging March 13-16 (Scottsdale, Ariz.). Contact International Microelectronics and Packaging Society, +1 (202) 548-4001; fax: +1 (202) 548-6115; e-mail: imaps@imaps.org.

Laser Safety in the Lab Course March 14-15 (Orlando, Fla.) Contact Laser Institute of America. +1 (407) 380-1553 or +1 (800) 345-2737; fax: +1 (407) 380-5588; e-mail: courses@laserinstitute.org; Web: www.laserinstitute.org.

Optical Terahertz Science and Technology Meeting March 14-16 (Orlando, Fla.). Contact Optical Society of America, +1 (202) 223-8130; fax: +1 (202) 223-1096; e-mail: info@osa.org; Web: www.osa.org.

APS March Meeting 2005 March 21-25 (Los Angeles). Contact American Physical Society, +1 (301) 209-3286; fax: +1 (301) 209-0866; e-mail: meetings@aps.org; Web: www.aps.org.

SPIE Defense & Security Symposium 2005 March 28-April 1 (Kissimmee, Fla.). Contact SPIE, +1 (360) 676-3290; fax: +1 (360) 647-1445; e-mail: spie@spie.org; Web: spie.org.

2005 MRS Spring Meeting March 28-April 1 (San Francisco). Contact Materials Research Society, +1 (724) 779-3003; fax: +1 (724) 779-8313; e-mail: info@mrs.org.

ASLMS 2005 Annual Meeting March 30-April 3 (Lake Buena Vista, Calif.). Contact American Society for Laser Medicine and Surgery, +1 (715) 845-9283; fax: +1 (715) 848-2493; e-mail: information@aslms.org; Web: www.aslms.org.

APRIL

Integrated Photonics Research and Applications April 11-13 (San Diego). Contact OSA, +1 (202) 223-8130; fax: +1 (202) 223-1096; e-mail: info@osa.org.

Nanophotonics for Information Systems April 13-15 (San Diego). Contact OSA, +1 (202) 223-8130; fax: +1 (202) 223-1096; e-mail: info@osa.org; Web: www.osa.org.

APS April Meeting 2005 April 16-19 (Tampa, Fla.). Contact American Physical Society, +1 (301) 209-3286; fax: +1 (301) 209-0866; e-mail: meetings@aps.org; Web: www.aps.org.

Tapered Fiber Provides NMR Sample Illumination

by Nancy D. Lamontagne

Photochemical nuclear magnetic resonance (NMR) experiments, such as photochemically induced dynamic nuclear polarization, and studies of protein surfaces and photoactive proteins require laser illumination of the sample inside the narrow bore of a superconducting NMR magnet. Efficient delivery of light to the sample, beyond and around the probe coils, capacitors, temperature control system and gradient coils, is difficult and has been a long-standing technical problem.

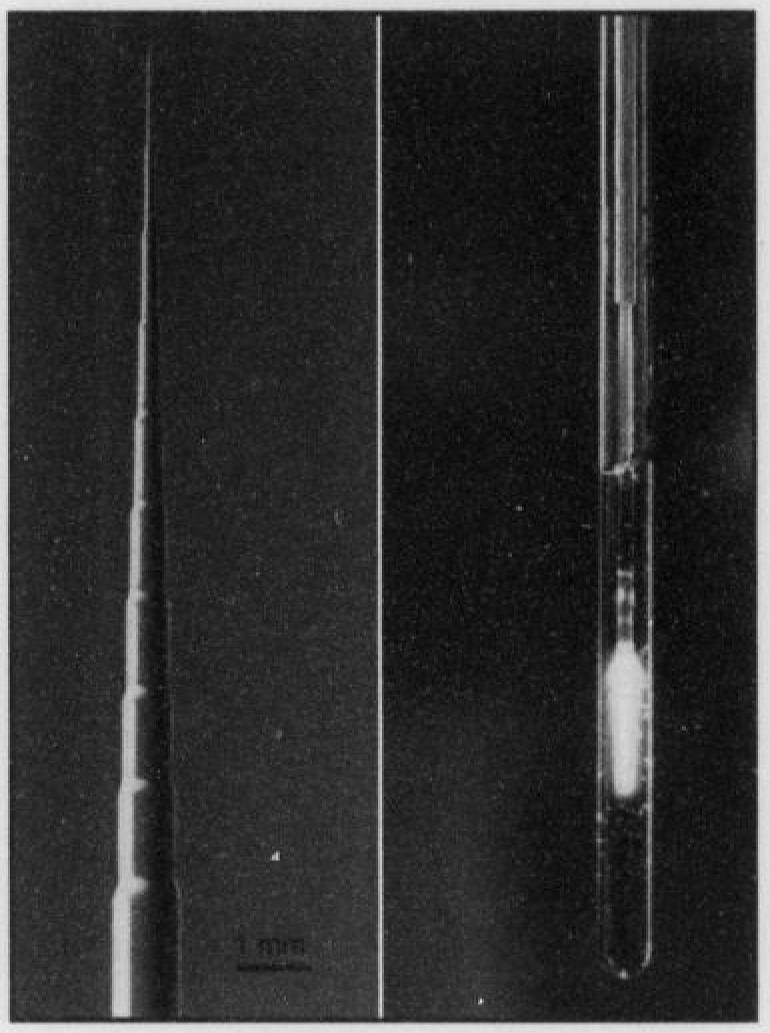
A research team at Oxford University in the UK recently suggested a thin tapered optical fiber as a means of efficient and uniform laser light delivery to the NMR sample.

A variety of sample illumination schemes have been tried, but none has been ideal. In the ideal case, the entire sample volume would receive light uniformly because nonuniform illumination generates concentration and temperature gradients that distort chemical kinetics and that bias the results. A good sample illumination setup also shouldn't require NMR probe modification, but should be easy to assemble and move from one spectrometer to another.

The tapered fiber developed by Ilya Kuprov and Peter J. Hore provides light from above the sample and scatters it uniformly along the axis of an NMR tube. To create the illuminating fiber, they used an etching process to step-taper one end of a Newport optical fiber that had a 1-mm-diameter core. They created fiber tips of various lengths that decreased diameters in seven to 15 steps.

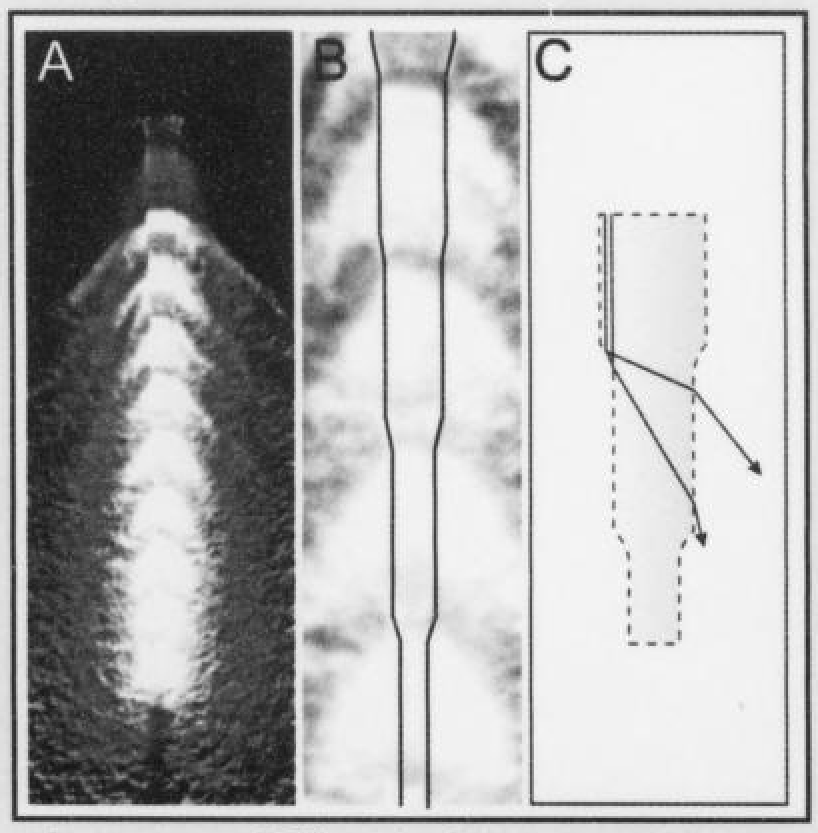
To measure the light intensity distribution within the sample, they used a ^{19}F photochemically induced dynamic nuclear polarization effect on 4-fluorophenol sensitized by flavin mononucleotide. The amount of nuclear polarization generated in this system is, in certain conditions, proportional to the local light density, which allowed measuring the light intensity profiles using NMR imaging techniques.

The researchers tested the fiber tips in a Varian Inova 600-MHz 14.1-T NMR spectrometer. A Spectra-Physics argon-ion laser operating in multiline mode at 10 W at predominantly 488 and 514 nm provided light pulses 100 ms long. The light was focused into a 6-m-long fiber via a Newport 53 objective lens. The other end of the fiber was connected to a 2-m-long fiber with a tapered tip that they placed inside a 5-mm NMR tube.



The tapered fiber on the left can be used for illumination in NMR experiments. On the right is the fiber illuminating a solution. The fiber cone is less than 50 µm but looks larger because of the lensing effect of the solution. Images reprinted with permission of the Journal of Magnetic Resonance.

They found that shorter cones (with steeper shoulders) tended to emit light predominantly from the shoulders, which produced nonuniform illumination. Very long cones with many steps emitted light only from the tip via total internal reflection. The best results came from cones with 10 to 15 1.0- to 1.5-mm steps. In these fibers, the vertical sections between the shoulders of the steps emitted light at ~45° to the fiber axis. The researchers noted that using steps to create the cone was essential because smooth cones emitted most of their light from the tip.



The tapered fiber is shown emitting on a white surface (A). A magnified portion of the center of A is shown in B. In C are the likely paths of the light rays.

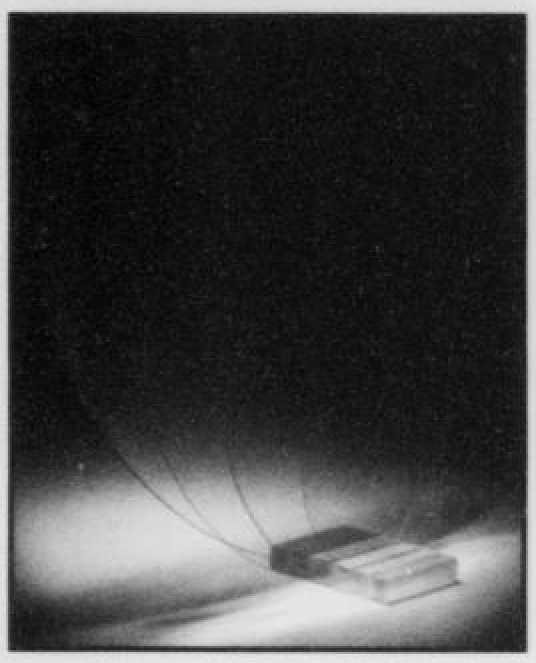
Their tests revealed that the fiber cone does not significantly deteriorate spectral resolution, and it displaces only about 5 percent of the total sample volume. In addition, it emits light into a volume around 25 mm² as compared with the 0.8 mm² area that a square-cut fiber can produce and, consequently, produces more homogeneous heating than a cut tip.

The researchers found that the tips were robust if they were free from scratches. If a tip did break from inaccurate insertion into the NMR, it could be repaired using the same etching process that produced it. Since the publication of this paper, they have worked with another group to use the setup to study GFP. ☐

Journal of Magnetic Resonance, November 2004, pp. 171-175.

Photonic Products

Glass Wafers in Less Than Two Weeks



Sydor Optics Inc.'s standard wafer sizes include 100, 150 and 200 mm with thickness down to 0.5 mm. We can deliver in less than two weeks. The wafers are processed on double-sided polishers with less than 10 arc sec of wedge and with transmitted wavefront error less than one wave. Custom wafers with different diameters, thicknesses and locating flats also are available.

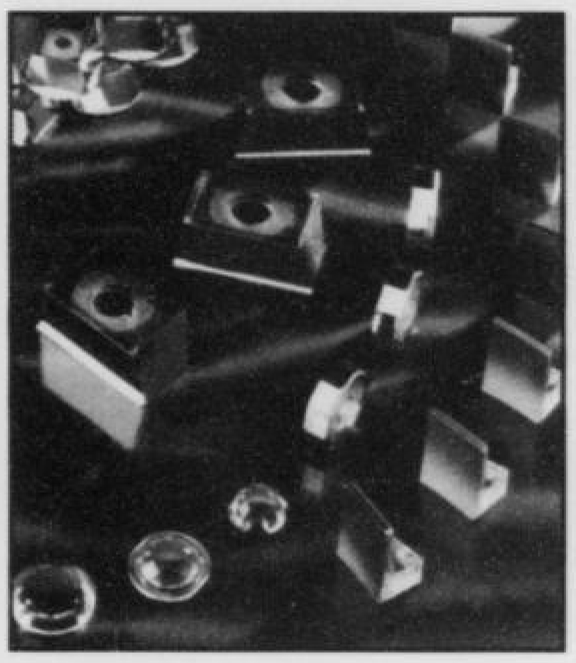
Sydor Optics Inc. **Circle No. 38**

Miniature PM Coupler

This miniature polarization-maintaining coupler features a 15-mm-long, 2 × 2-mm-section solid-glass assembly that meets Telcordia GCORE 1221 and 1209 environmental specifications. The device features a high polarization extinction ratio of up to −30 dB and very low loss of <0.1 dB for wavelengths from 488 to 1560 nm.

Canadian Instrumentation & Research Ltd.
Circle No. 39

Precision Polymer Optics



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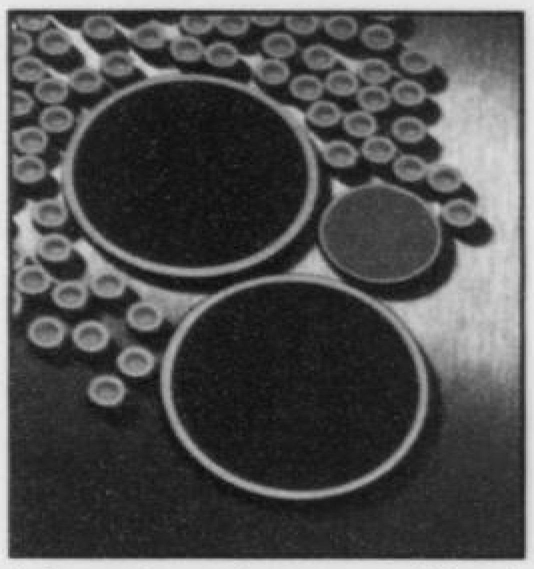
G-S PLASTIC OPTICS **Circle No. 40**

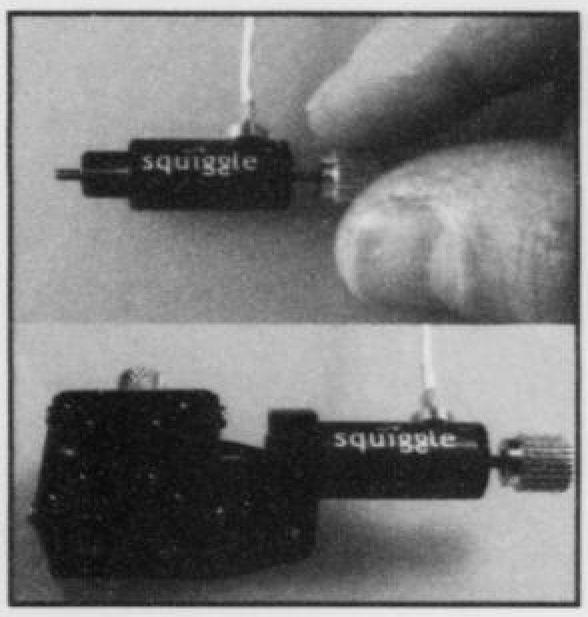
Solderable Metallization



Brysen's metallization designs are multilayer coatings for hermetically sealing optical windows and filters. Proven designs for a variety of substrate types allow us to offer metallizations as a complement to our optical thin films, providing our customers with a single source for solderable coated components. These coatings exhibit excellent adhesion and pass solderability, high temperature and cryogenic testing. Combined with Brysen's high-quality infrared coatings, metallized components are currently being provided for use in infrared cameras and detector Dewars.

Brysen Optical Corp. **Circle No. 41**

Tiny SQUIGGLE™ Motors and Stages



SQUIGGLE motors and linear stages are now 50 percent smaller and operate at cryogenic temperatures. This new and patent-pending motor design is powered by piezoelectric ceramics that ultrasonically vibrate a threaded nut to directly rotate a screw. SQUIGGLE motors are smaller, quieter, faster, nonmagnetic and vacuum compatible.

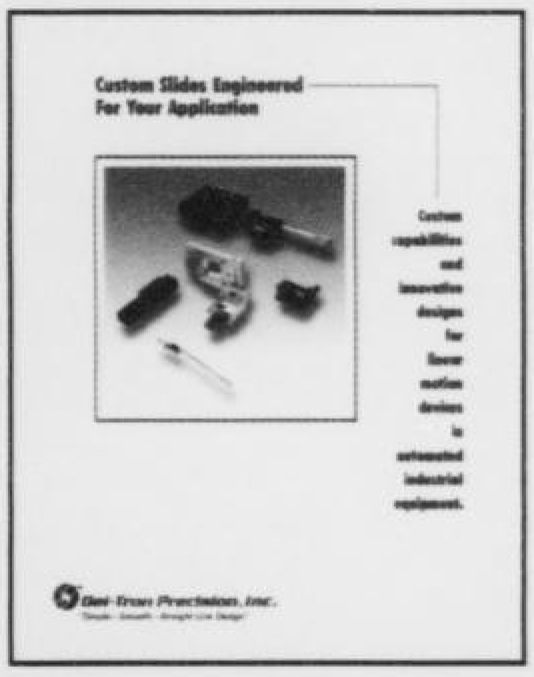
New Scale Technologies Inc.
Circle No. 42

Custom Polymer Optics

Syntec Technologies delivers the highest-quality polymer optics from design through manufacture to a wide range of industries, including biomedical, biometric and defense. With a system-wide focus on design for manufacturability, proprietary RAMP (rapid assembly and manufacturing process) techniques, and full supply chain management, Syntec offers solutions that cost less and do more.

Syntec Technologies Inc. **Circle No. 43**

Custom Slides for Your Application



Custom Slides Engineered For Your Application

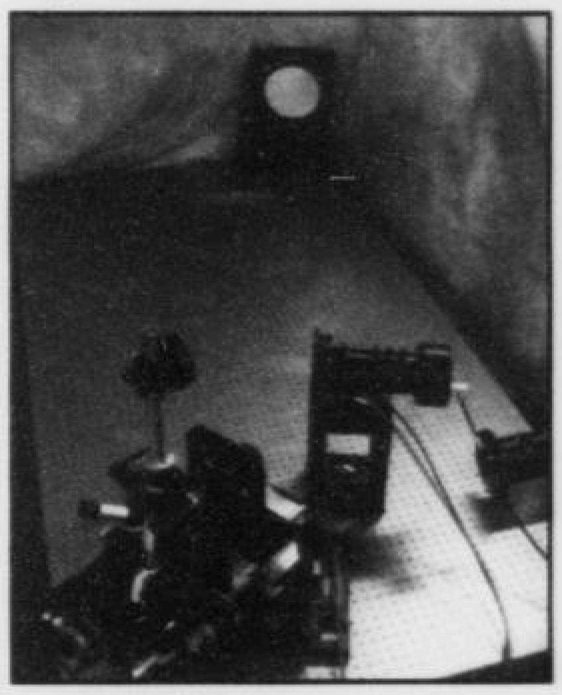
Custom capabilities and innovative designs for linear motion devices in automated industrial equipment.

Del-Tron Precision, Inc.

Del-Tron Precision Inc. provides custom capabilities and innovative designs for linear motion devices in automated industrial equipment. We can modify our products for special applications by reducing overall height or producing shorter carriages or bases. We can integrate the base and carriage of an X-Y stage to reduce height. We offer side-drive micrometer heads for our positioners, reducing length by up to 4 in.

Del-Tron Precision Inc.
Circle No. 44

OpTest Lens Test Systems

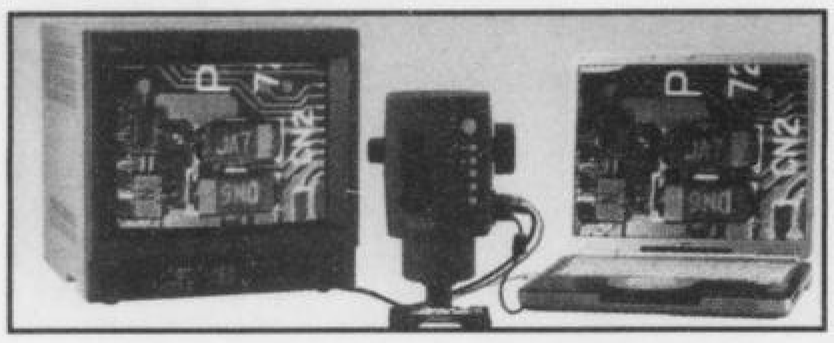


Optikos Corporation offers complete solutions to visible and infrared lens manufacturers for validating image quality. The OpTest product line comprises precision instruments designed to measure optical transfer function. These systems can test MTF, effective focal length, distortion, astigmatism, field curvature and many other parameters. Contact us to discuss your optical test requirements.

Optikos Corporation **Circle No. 45**

Photonic Products

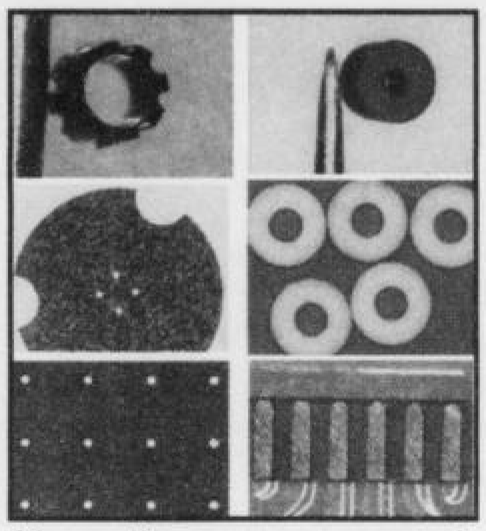
Inspection Microscope



The INF-500 microscope from Moritex USA Inc. is a powerful, high-quality imaging tool for inspection and presentation applications. Because it is equipped with both video (analog) and USB 2.0 (digital) outputs, it would be difficult to find a situation where the INF-500 could not be used to share vivid close-up images. Software is supplied for image display via a computer.

Moritex **Circle No. 46**

Laser Micromachining Services



For those who think small and very precise. Gateway Laser Services specializes in laser processing of very small components requiring extremely high tolerances. Typical micromachining applications: orifices, arrays, channels, apertures, tubes, nozzles, washers, membranes, connectors, masks, flex circuits, laser welding, marking, engraving. We work with a variety of materials, including: most metals and alloys, ceramics, polyimides, ultem, peek, thin films, silicon, Kovar Hytrel, polycarbonate, duroid, silicone and epoxy preforms.

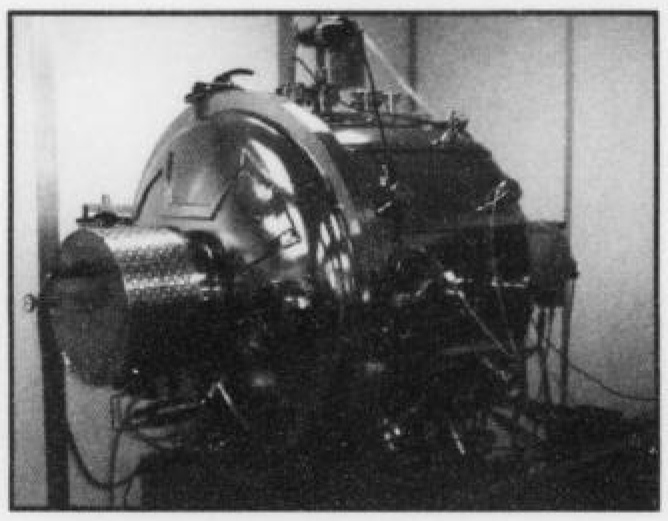
Gateway Laser Services **Circle No. 47**

Specialized Optical Tooling

Specializing in optical injection mold building and tooling design, RTM provides designs for manufacturability and can mold rapid prototypes in polymers, metal or crystal. RTM also offers single-point diamond turning and a full-service metrology lab. Our capabilities include wire and die sink electron discharge machining, precision grinding and polishing, CNC milling and lathing, and a fully integrated CAD system.

Rochester Tool & Mold **Circle No. 48**

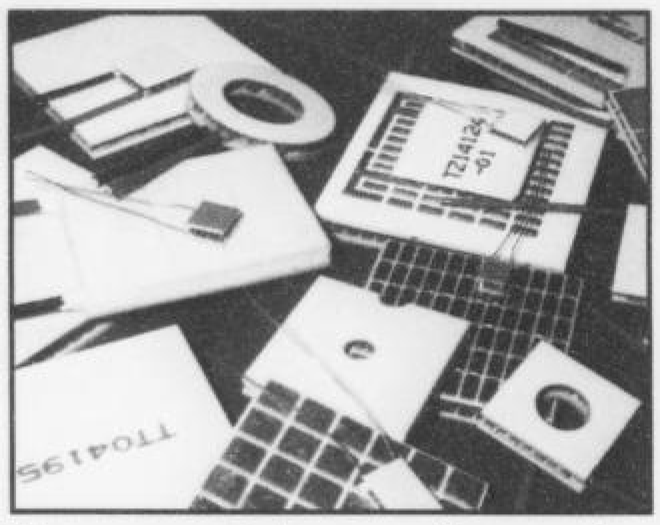
Innovative Thin-Film Coatings



We offer ion-beam-sputtered optical coatings with the highest packing density of any deposited technique, providing exceptional adhesion, abrasion resistance and durability. We also offer ion-assisted electron beam, electron beam and resistance source films for wavelengths in the UV to the NIR. Multilayer filters, reflectors and AR coatings. Metallic mirrors and ND filters. Standard and custom capabilities.

Guernsey Coating Laboratories Inc. **Circle No. 49**

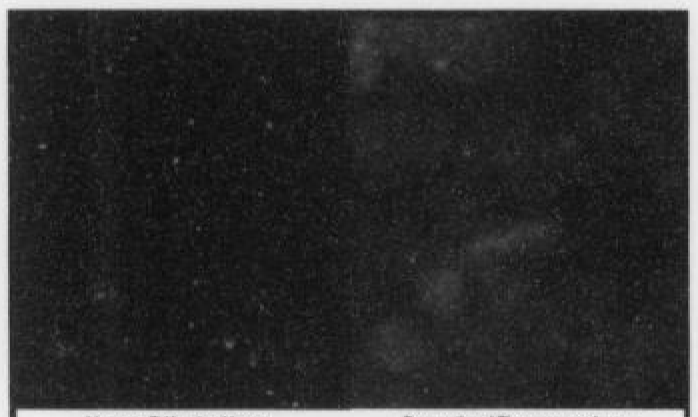
Thermoelectric Modules and Assemblies



Ferrotec manufactures high-quality, high-reliability thermoelectric modules and TE-based assemblies for a wide variety of applications in the scientific, medical and instrumentation industries. The combination of our global presence, technical staff and Chinese manufacturing make us an attractive supply partner for companies of all sizes. How can we help you with your thermal management needs?

Ferrotec (USA) Corporation **Circle No. 50**

Nuance™ Multispectral Imaging Systems

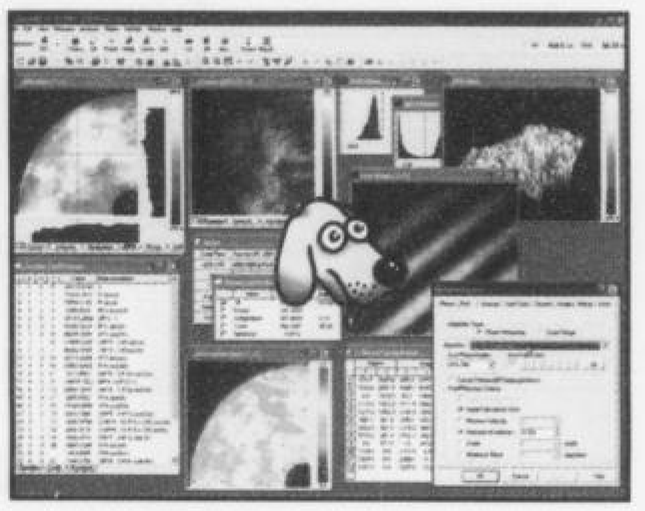


DAPI (Nuclei), FITC (Chromosome 17), and Cy3 (HER-2) unmixed from atypical ductal hyperplasia tissue autofluorescence. Sample courtesy D. Pinkel and D.G. Albertson, UCSF, San Francisco, CA

Remove contrast-robbing autofluorescence, detect multiple dyes (even when colocalized), and improve your sensitivity for FRET, FISH and bright-field microscopy. Easy-to-use Nuance multispectral imaging systems also can be used for forensics, remote sensing, and quality assurance/quality control research. A fast USB 2.0 interface and intuitive Windows software are included, and the systems are available in VIS, NIR and fluorescence-optimized models.

CRI Inc. **Circle No. 51**

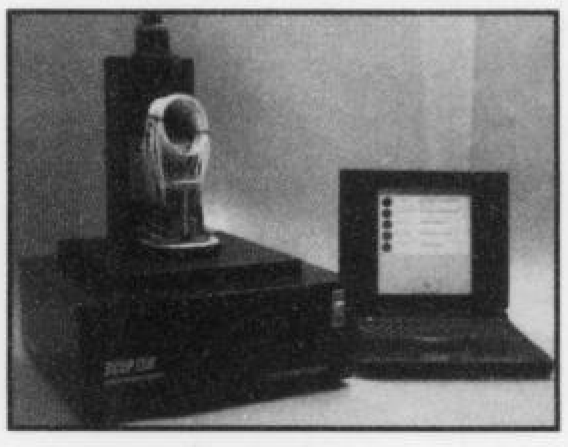
Durango Interferometry Software



Durango software brings superior phase-shifting and static analysis to almost any interferometer. Download Durango and immediately enjoy full control over interferogram analysis and total access to measurement data. Contact us for a CD-ROM or with licensing questions.

Diffraction International
Circle No. 52

PC-Controlled Optical Polisher



Krell Technologies' Scepter™ is PC-controlled for consistent and efficient connector and bare fiber polishing. Technicians are prompted through each process via the user-friendly interface. Various polishing procedures are easily programmed for all connector types and surface finishes. Scepter workholders incorporate Krell's unique independent suspension and optical alignment design for uniform polishing at each connector position, and maximum usage of consumables.

Krell Technologies **Circle No. 53**

MY PRINCIPAL JOB FUNCTION IS: (insert code) 1

Engineering and Science Related
- A. research & development
- B. design
- C. application
- D. production and manufacturing
- E. measurement (testing, quality control or safety)
- F. other engineering or science function (please specify)________

Management Related
- G. corporate
- H. technical
- J. production & manufacturing
- K. purchasing
- L. other management function (please specify)________

Other
- M. consultant
- N. educator
- P. other functions (please specify) ________

PLEASE INDICATE THE PRIMARY END PRODUCT OR SERVICE OF YOUR COMPANY AT THIS LOCATION. (insert code) 2
- A. aerospace/aviation systems
- B. agriculture, food, forestry and mining
- C. analytical, test or measuremen instrumentation
- D. automotive or transportation
- E. cable TV/video/broadcasting
- F. chemical or pharmaceutical products
- G. communication services (incl. telcos, RBOC & other carriers)
- H. computer, peripherals, office and business equipment
- J. consumer electronics & appliances
- K. electronics, semiconductors and IC
- L. electro-optical components, detectors, sensors and cameras
- M. environmental monitoring
- N. federally funded laboratory (military or civilian)
- P. fiber optic components or systems
- Q. hospital/medical university or office
- R. industrial control systems and robotics
- S. lasers/laser systems
- T. manufacturing equipment, machinery or metal products
- U. medical and biotechnology equipment
- V. military equipment
- W. navigation and guidance systems or equipment
- X. optical components, materials or systems
- Y. plastics, polymers, rubber
- Z. printing, publishing, graphic arts
- 1. university/institution/college
- 2. utilities, energy, petroleum and coal
- 3. government personnel not classified elsewhere
- 4. industrial company or commercial user incorporating photonics products not classifed elsewhere
- 5. other ________

NUMBER OF EMPLOYEES AT THIS LOCATION (insert code) 3
- A. 1-10
- B. 11-25
- C. 26-50
- D. 51-100
- E. 101-500
- F. 501-1000
- G. 1001-5000
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SHOW 01/05

PHOTONICS PROBLEM-SOLVER

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Nanopositioning Stage Pulls Piconewtons in Molecular Stretching Application

A multiaxis closed-loop piezo stage can generate forces of piconewtons at subnanometer displacement resolution.

by Stefan Vorndran, Physik Instrumente (PI) GmbH & Co. KG, Karlsruhe, Germany

Nanopositioning, the art of controlling motion on the nanometer scale and below, has been a key enabling technology in many high-tech fields. The need for miniaturization in industries such as semiconductors, telecommunications and data storage has driven the development of faster and higher-resolution motion systems over the past decades. More recently, nanopositioning devices also have been employed in biotechnology applications, and the latest developments in this technology are fostering progress in molecular biology.

Research at the Fernandez Lab at Columbia University in New York focuses on the mechanical properties of single molecules, such as proteins or saccharides, using atomic force microscopy. These properties are extremely relevant to the understanding of biological processes. Scientists can deduce the structural features of the molecules based on the observed mechanical stability and the conformational changes that occur upon the application of force.

The basic principle of the technique involves the stretching of a molecule between a gold surface and the tip of a microscopic cantilever (Figures 1 and 2). The forces involved are incredibly small, on the order of piconewtons; 10 pN are equivalent to the force exerted by one-billionth of a gram.

The stretching experiment is run in either force- or velocity-control mode. Both require proportional integral derivative feedback. The measured force-extension relationship helps to explain the structural features of the molecules (Figure 3). The length of the molecule as a function of the force is obtained from the displacement of the substrate.

Because the forces are so minute and the distances involved only a few nanometers, all the equipment used in the experiment must be of the highest precision and sensitivity. Two crucial elements in the setup are the nanopositioning stage and its position measurement system. A main requirement of the stage is that all of the parts in the motion system (actuator, sensor, guidance) be friction-free. This rules out classical positioning stages that have ball or roller bearings.

The nanopositioning system used in the Fernandez research is a PicoCube multiaxis closed-loop piezo stage

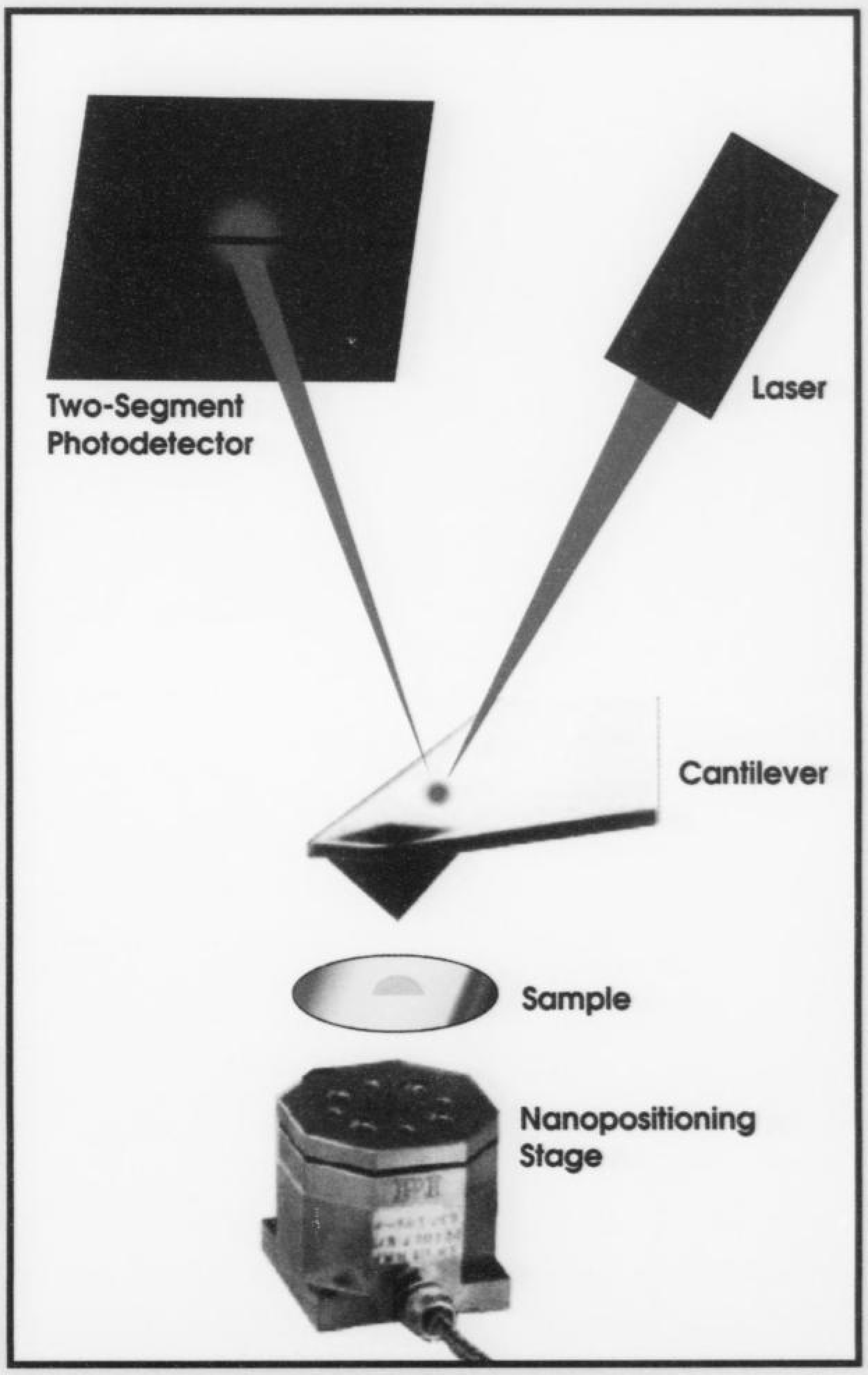


Figure 1. The basic setup of the molecule stretching application involves the PicoCube stage moving the sample and measuring the position via an integrated subnanometer-precision capacitive sensor. The cantilever, laser and photodetector provide force feedback. Courtesy of Fernandez Lab.

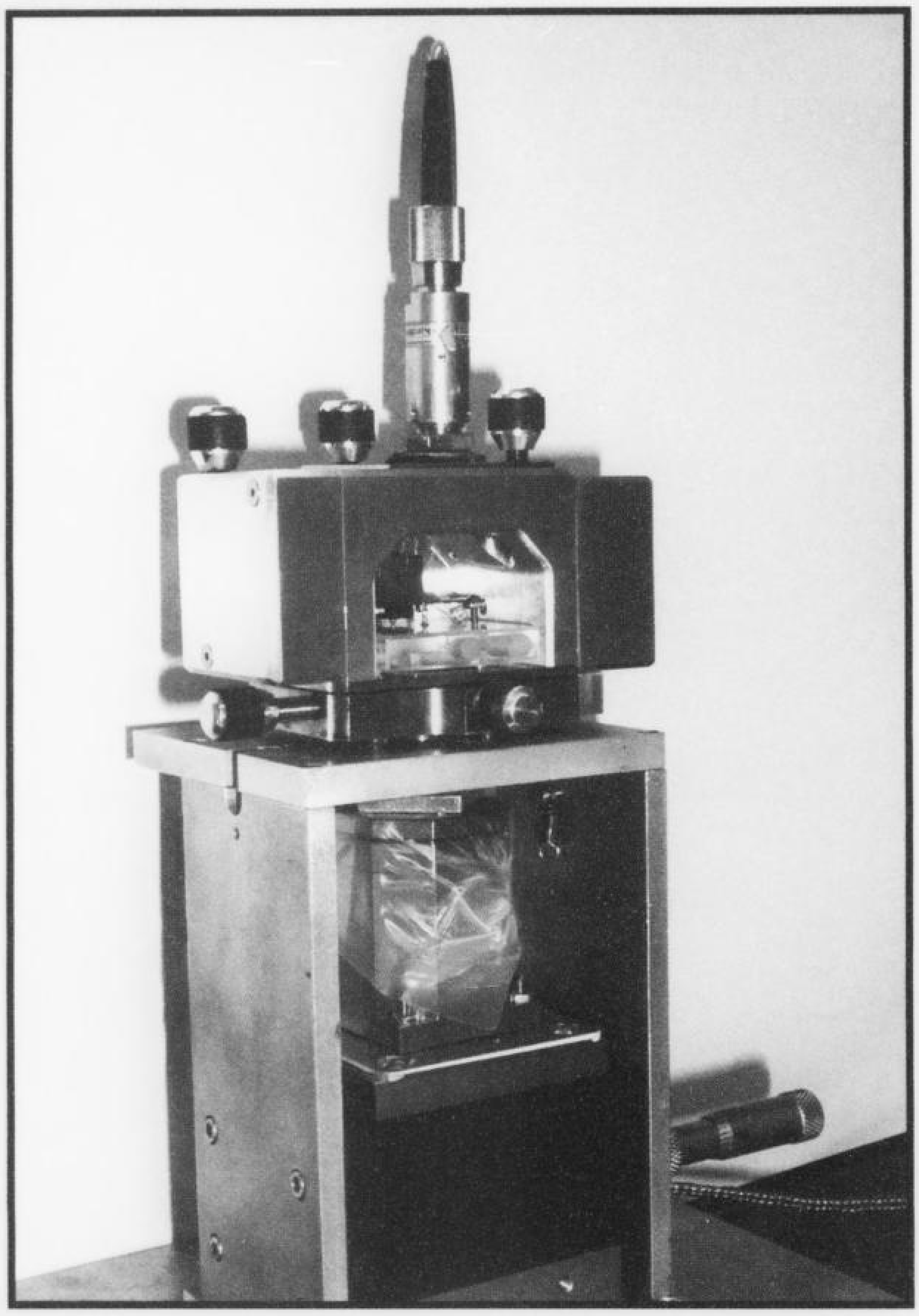


Figure 2. The apparatus stretches the molecule between a gold surface and the tip of a microscopic cantilever. Courtesy of Fernandez Lab.

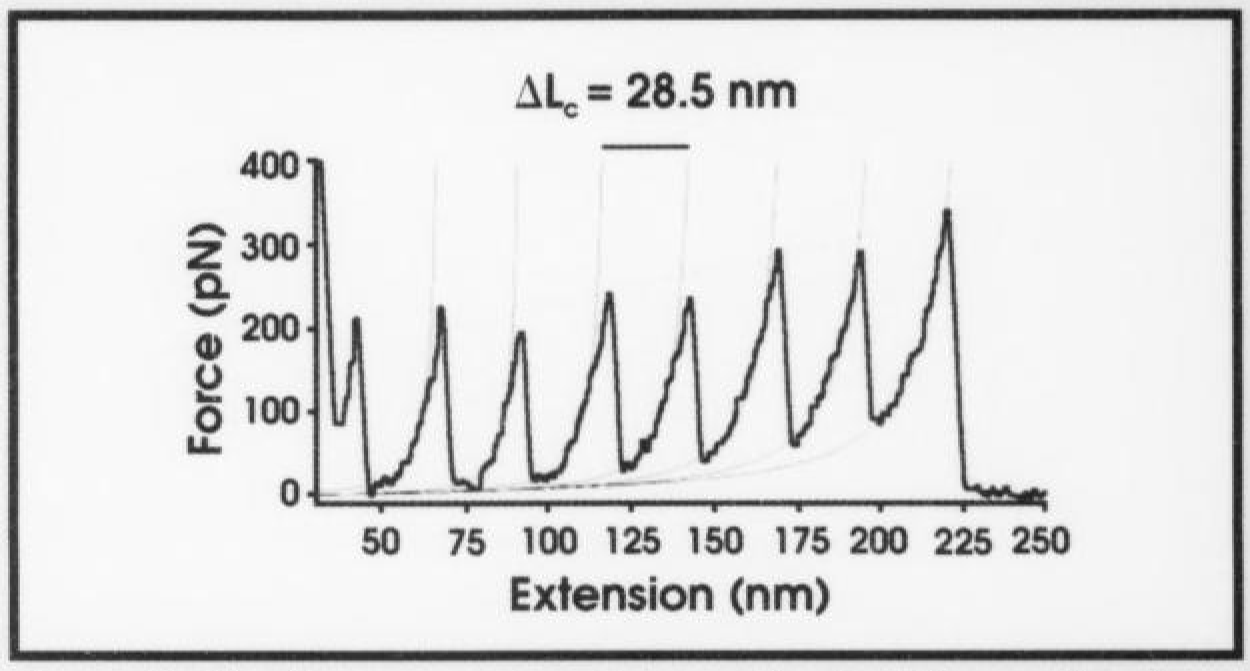


Figure 3. The force vs. extension graph of a titin molecule shows that the protein is composed of structurally rigid and nonrigid elements. Courtesy of Fernandez Lab.

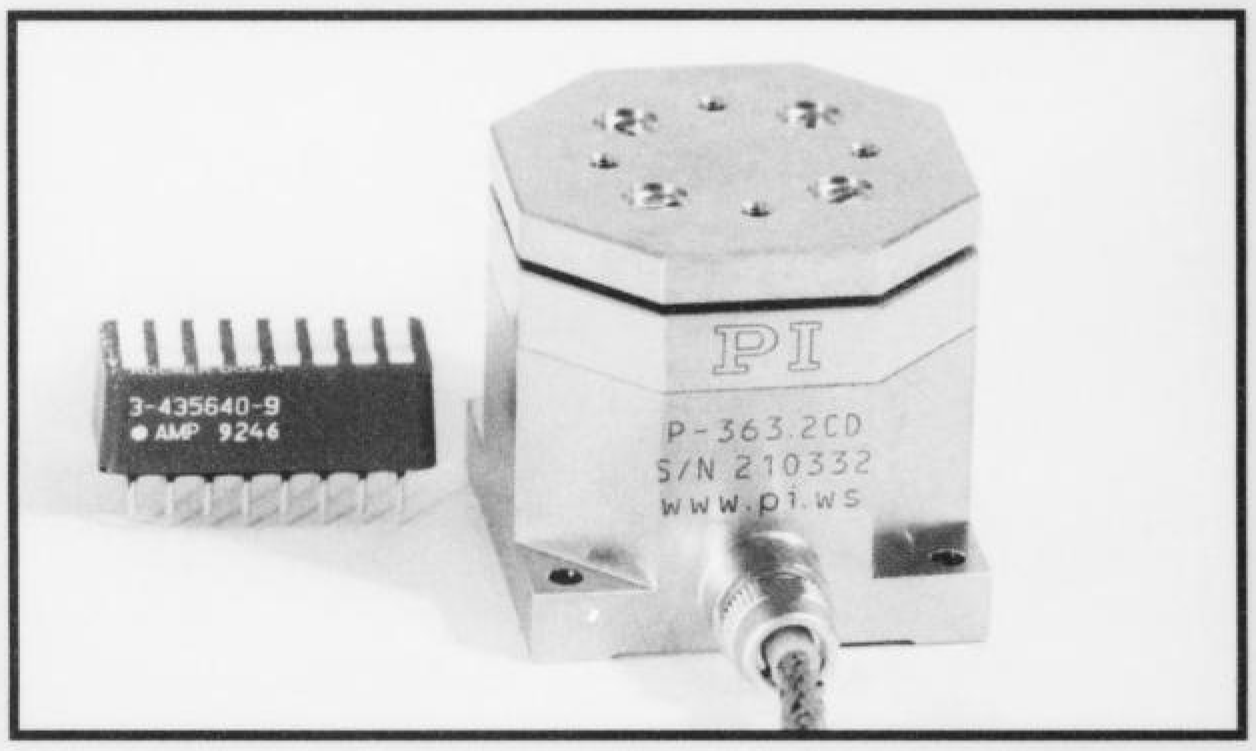


Figure 4. The PicoCube is available in two- or three-axis versions. The DIP switch is shown for size comparison.

from Physik Instrumente (PI) GmbH & Co. KG. It is equipped with a noncontact, direct metrology, capacitive measurement system (Figures 4 and 5).

Capacitive sensors have emerged as the default choice for nanopositioning applications with travel ranges of less than 1 mm. They are compact, high-bandwidth, absolute measuring devices (no homing procedure) that provide very good linearity and long-term stability with subnanometer resolution. These features make them ideal sensors for precisely determining the length of the molecules.

Both the actuator and the sensor have a very high bandwidth of several kilohertz and can be used for fast scanning operations. The high mechanical resonance frequency of the stage is the result of a very stiff mechanical design, important for structural stability at the nanometer level.

The PicoCube system boasts a number of novel features, such as low-inertia bipolar piezo drives and parallel metrology sensors. The bipolar drives allow for a larger travel range than piezo drives similar in size and, thus, a more compact and stiffer package. As a further benefit, the piezo drive voltage at the center of travel is zero, which means that the potential for failure also is zero. The use of parallel capacitive sensors to measure the single moving platform means that the orthogonal axes automatically compensate for each other's crosstalk (active trajectory control).

PI's nanopositioning stages provide travel ranges from 5 µm to 1 mm and motion from one to six degrees of freedom. They can be controlled by a variety of analog or digital controllers. Analog types are convenient in applications with analog control signals. Digital ones, on the other hand, offer a number of advanced features such as dynamic linearization, virtually eliminating tracking errors in high-speed scanning applications. They also allow the use of autocalibrating mechanics and the changing of servo and systems parameters on the fly. □

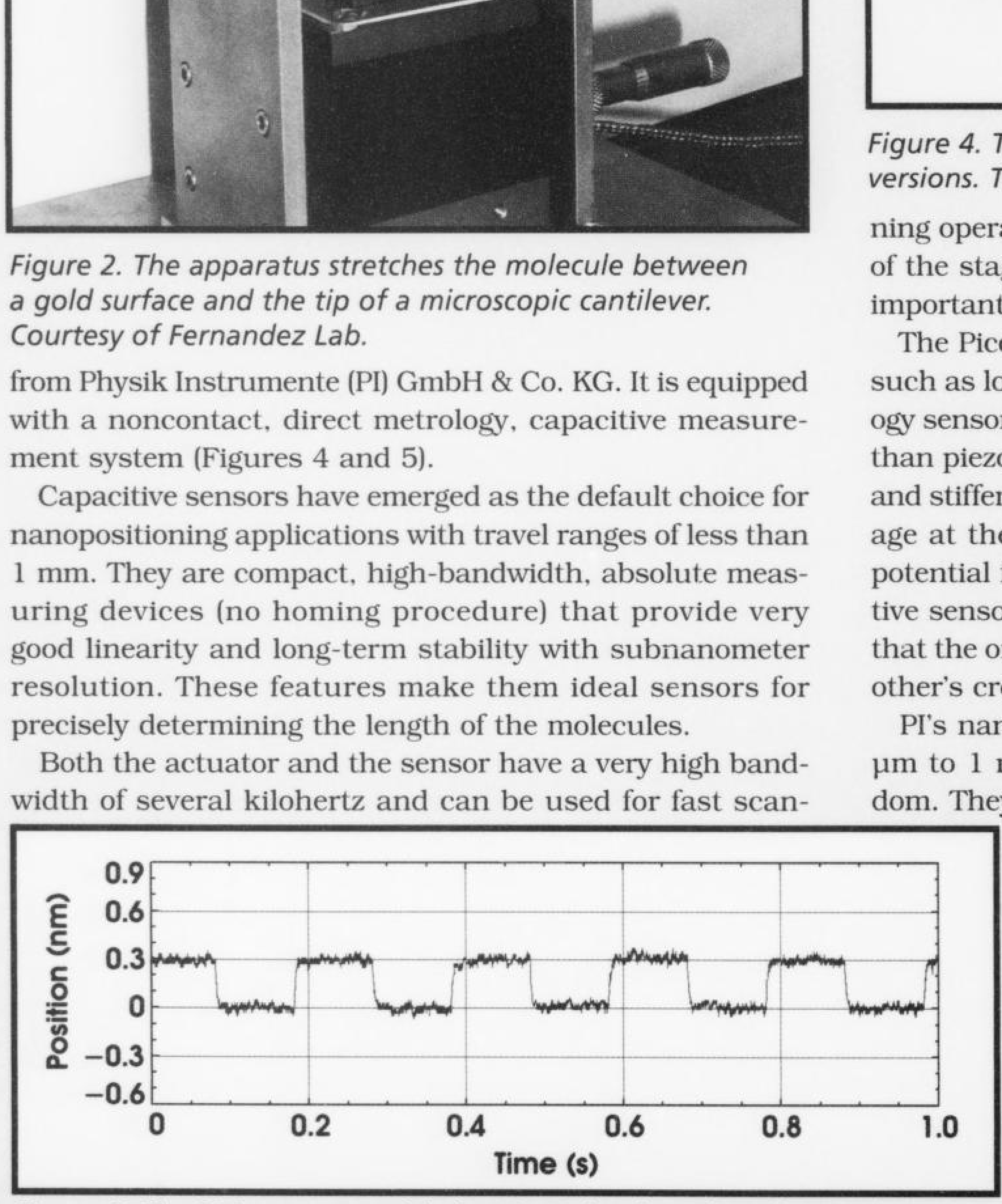
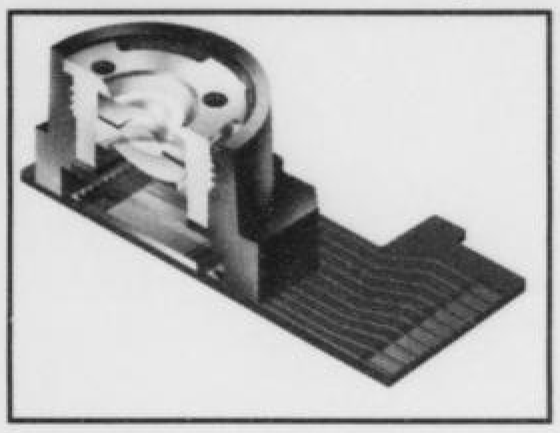


Figure 5. The 300-pm steps with the PicoCube show how fast and repeatably the system responds to positioning commands. The theoretical resolution (limited by electrical noise) is approximately 50 pm.

Contact: Stefan Vorndran, PI (Physik Instrumente) LP; fax: +49 721 4846 100; e-mail: stefanv@pi-usa.us.

Photonic Products and Media

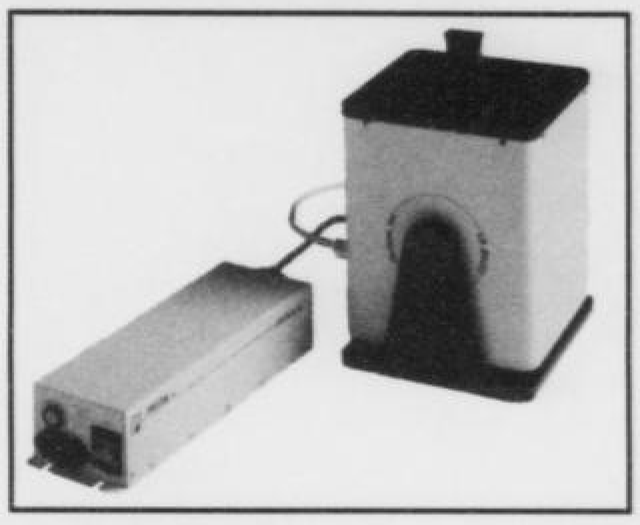
Adhesives for Digital Image Sensors



Ablestik manufactures a complete line of adhesives for image sensor applications. The Ablebond 8387B series nonconductive adhesives feature low-temperature cure and black pigmentation for lens holder attachment. The Ablebond 2030 series die attach adhesives are designed for CCM/CMOS/CCD devices. Available in conductive and nonconductive versions, they feature low-temperature fast cure and low outgassing.

Ablestik Circle No. 54

Far-Field Profiler



Photon's patented far-field profilers enable measurement of divergent light from LDs, VCSELS, LEDs, waveguides and fibers quickly and easily for improved yield and optimized optical design. Measure a variety of source configurations and devices with semicustom adapter plates. Single-axis, X-Y and full 3-D characterization of sources is possible without moving either the source or the detector.

Photon Inc. Circle No. 55

Linear Position Sensor Module

NOAH's linear position sensor module simplifies laser beam alignment and position tracking applications. The module combines a duolateral silicon position-sensing detector, transimpedance amplifiers and sum/divider circuitry in a compact package. The detector measures beam displacement on two axes and generates normalized displacement signals for X and Y that can be connected directly to an oscilloscope.

NOAH Industries Inc.
Circle No. 74

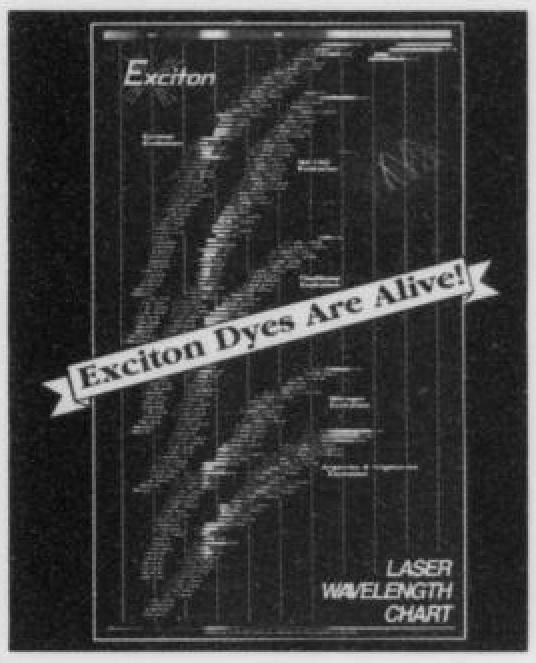
OptiSpheric Optical Measurements

OptiSpheric®
The Industry's Standard for Lens Testing
TRIOPTICS

OptiSpheric is a PC-based optical test station that is designed to accurately measure the optical parameters of lenses and optical assemblies. OptiSpheric can accurately measure EFL, BFL, FFL MTF, radius and centering errors in lenses. OptiSpheric can be upgraded to measure plano optics such as wedge angle, mirror tilt and parallelism of windows by adding a software module and mechanical accessories.

Mildex Inc. Circle No. 57

Laser Wavelength Chart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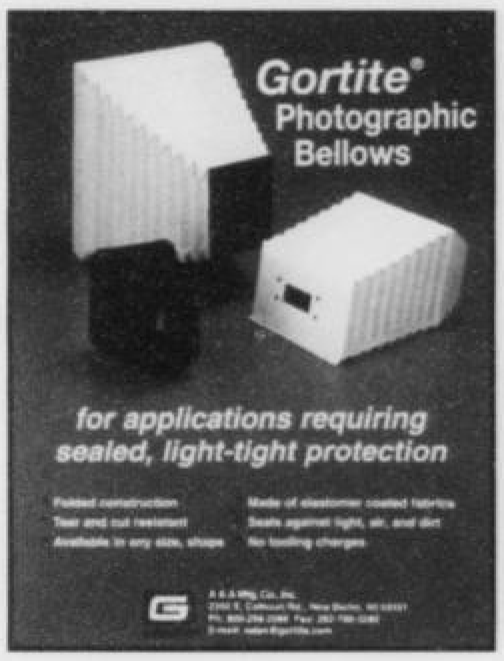
LASER WAVELENGTH CHART

Exciton is dedicated to providing its customers with the highest-quality laser dyes on the market today. To assist its customers in choosing laser dyes, Exciton offers a free four-color laser wavelength chart, an essential reference for your laboratory or office wall.

Exciton Inc. Circle No. 58

Photographic Bellows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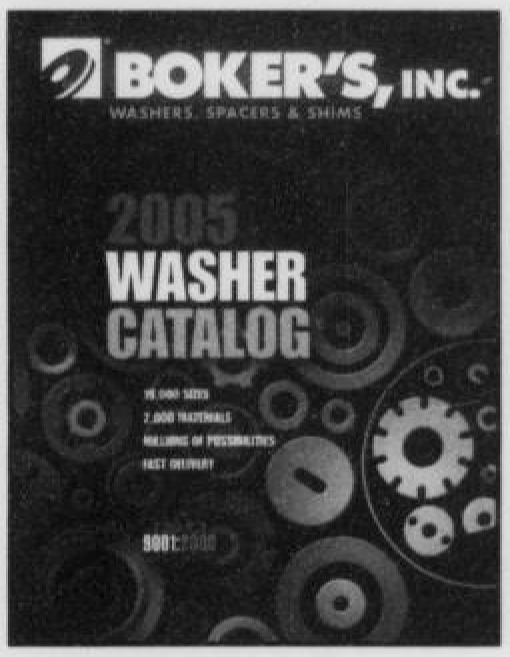
A&A Mfg. Co. Inc. Circle No. 59

Washers, Spacers and Shims Catalog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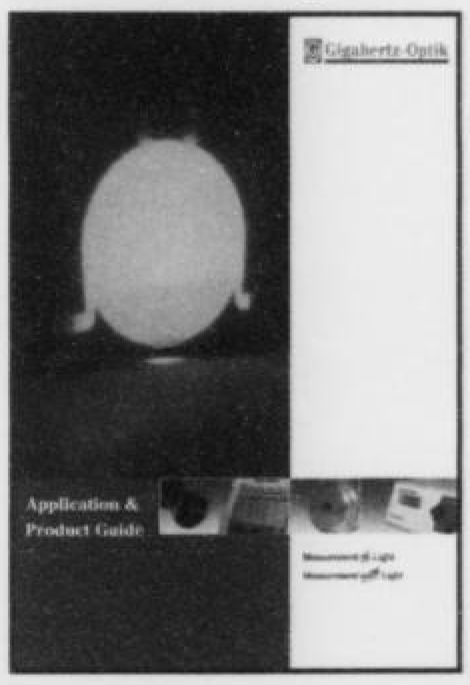
Boker's free 52-page Catalog 2005 has more than 19,000 nonstandard sizes available with no tool charges. Outside diameters of 0.080 to 5.140 in., a variety of inside diameters and thicknesses, and 2000 material variations provide numerous possibilities. Metallic materials include low-carbon steel sheet, five types of spring steel, stainless steel, aluminum, brass, copper and nickel silver. Nonmetallic ones such as Delrin, Teflon, Mylar and nylon are listed in bold for quick reference. Metric sizes are available.

Boker's Inc. Circle No. 60

Guide to Light-Measurement Solutions


Gigahertz-Optik
Application & Product Guide

The Gigahertz-Optik Application & Product Guide covers instrumentation for the measurement *of* light and for measurement *with* light, including UV-VIS-NIR radiometers, photometers, color meters, integrating spheres, power/noise/pulse analyzers, uniform light sources, reflectance/transmittance meters and materials, and calibration standards for research, industrial, medical, environmental and OEM applications. More than 50 pages of tutorials are included.

Gigahertz-Optik Inc. Circle No. 61

Photonic Media

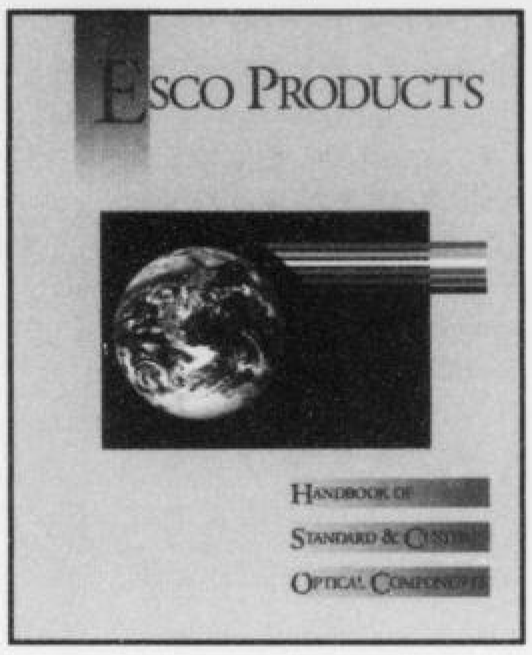
Laboratory Mechanicals Catalog

Siskiyou
Design Instruments

Siskiyou Design Instruments' 2004/2005 catalog contains more than 400 items on 240 pages. Optical positioning equipment, motion control devices and a wide range of hardware make up the selection. Whether setting up a laboratory or trying to fill an OEM requirement, you will find products designed to meet your needs. Designed, manufactured and distributed at our facility in Grants Pass, Ore.

Siskiyou Design Instruments
Circle No. 62

Precision Optics Handbook



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Esco Products **Circle No. 63**

DC-DC Converters up to 10,000 VDC

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Surface Mount and Plug-In Transformers and Inductors... from .19" height!
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The 178-page PICO catalog #2028 features more than 250 surface-mount and through-hole DC-DC converters for PIN diode, laser and photomultiplier applications. These high-voltage models offer 2 to 10,000 V of output. High-reliability designs are available in industrial, COTS and military upgrades. Power ratings from 1 to 500 W and seven input ranges. Stock to one week; special voltages two to four weeks.

PICO Electronics **Circle No. 64**

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Capovani Brothers Inc. specializes in the purchase, refurbishment and resale of high-technology equipment associated with the semiconductor and photonics industries. We have been successful in our mission of providing quality used equipment at a great value. Our entire inventory is updated daily and is available on our Web site.

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Focused Solutions for Integrated Optics

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LightWorks

LightWorks Optics focuses on the needs of the defense, space and commercial markets, closely collaborating with our customers to integrate design and manufacture on the most demanding projects. Our engineering team has developed solutions for an impressive array of advanced optical systems. Our manufacturing capabilities include state-of-the-art single-point diamond turning in addition to facilities for assembly, integration and testing of complex optical systems.

LightWorks Optics Inc.
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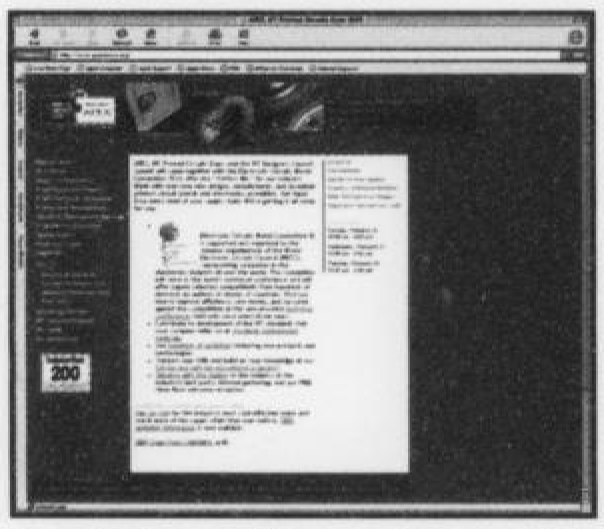
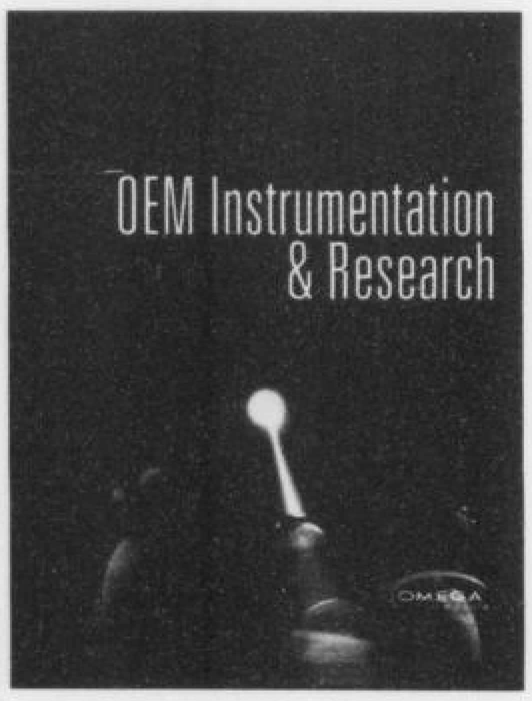
Manufacturing Solutions



Solve your manufacturing challenges at APEX, the premier industry conference and exhibition for the electronics manufacturing, assembly and test industries. Featured will be Electronic Circuits World Convention 10, a global technical conference. Join hundreds of exhibitors and thousands of peers and industry experts focusing on electronics manufacturing and optoelectronics issues. The conference takes place Feb. 22 through 24, 2005, in Anaheim, Calif.

IPC

Precision Interference Filters Catalog



Omega Optical has published a new capabilities and technology catalog. *Precision Optical Filters for OEM Instrumentation & Research* is a technical handbook that encompasses optical interference filter theory, design, coatings, filter types and system design considerations. It is directed at OEMs and at researchers designing analytical instrumentation for a variety of markets and applications. Also included are sections on collaborative engineering services and subassembly contracting.

Omega Optical Inc. **Circle No. 68**

Motion Design Catalog

Specialty Motions, Inc.
specialtymotions.com/m.htm

SMI has developed an entire series of economical, precision miniature mechanical solutions that are ready to drop into your next motion application. Choose from components to complete solutions, from ball slides to cross roller, from manual to motorized and from single- to multiaxis, with sizes available to fit most major suppliers, dimensions at sensible prices. Visit our Web site for details and pricing.

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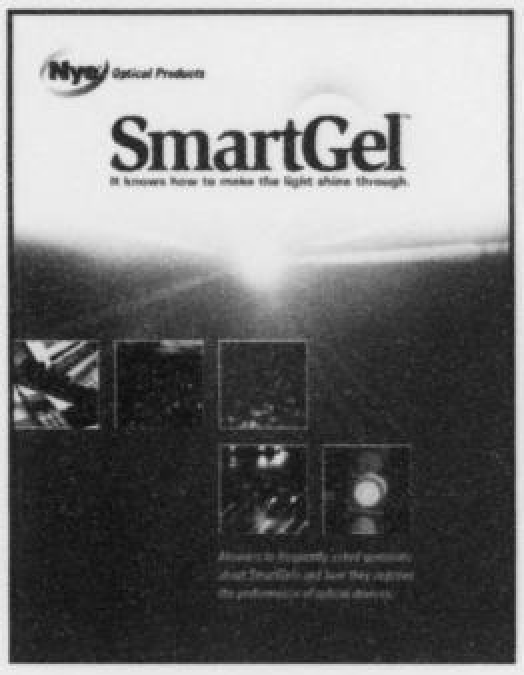
Photonic Media

SmartGel® Optical Tutorial


Nye Optical Products
SmartGel
It knows how to make the light shine through.

SmartGels are the new rugged alternative to optical epoxies. They're improving the efficiency and reliability of high-brightness LEDs, backlit displays, CCD cameras, automotive lighting, architectural signage and other devices where light must pass through mated plastic or glass. Learn more about these index-matching optical gels in this informative tutorial from Nye.

Nye Lubricants Inc. **Circle No. 70**

Off-the-Shelf Optics

ROLYN
Optics Company
Optics for Industry

A free 140-page catalog is available from Rolyn Optics, one of the world's largest suppliers of off-the-shelf optics. Delivered in 24 hours are stock lenses, filters, prisms, mirrors, beamsplitters, reticles, objectives and eyepieces. Rolyn's all-aluminum universal lens mounts hold stock lenses simply by threading a retaining ring inside the lens mount, inserting the lens and securing it with a spanner wrench. Custom products and coatings are available in prototype or production quantities.

Rolyn Optics **Circle No. 71**

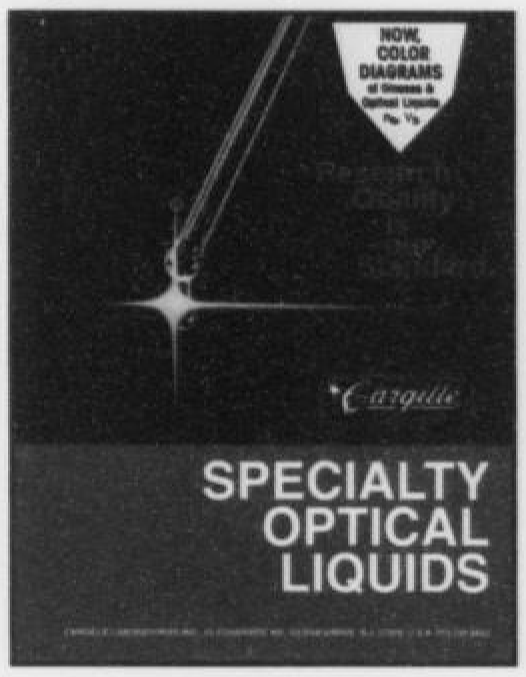
Miniature Precision Linear Motion

Specialty Motions, Inc.
specialtymotions.com/p.htm

We offer economical solutions to miniature precision mechanical motion requirements, with prepackaged solutions ready to mount and move. Manual, motorized and micrometer-actuated components are available. Choose from SMI's extensive selection to build your own system, or furnish concept requirements for custom turnkey solutions. SMI can deliver single- and multiaxis components, from ultra precision to economical versions.

Specialty Motions Inc.
Circle No. 72

Optical Liquids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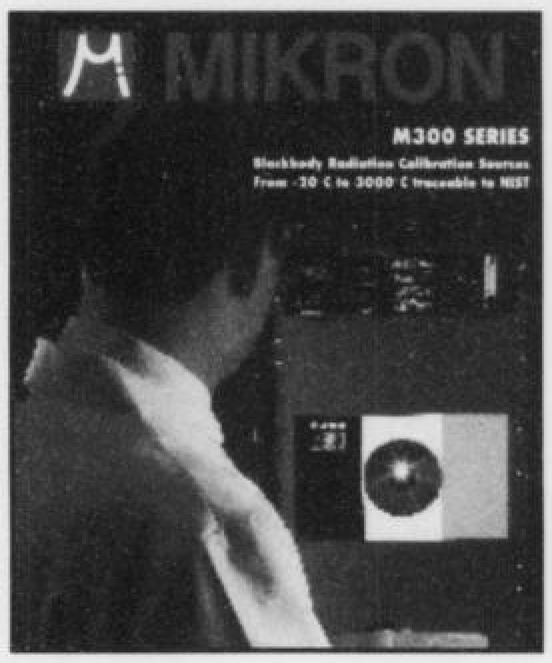
Cargille
SPECIALTY OPTICAL LIQUIDS

This *Specialty Optical Liquids* catalog features high-transmission, safe-handling laser liquids, fused silica matching liquids and specific refractive index liquids (1.300 to 2.11 n_D). Also featured are transparent and light-absorbing gels. The catalog now includes comparative diagrams of glasses and optical liquids.

Cargille Labs **Circle No. 73**

Radiation Calibration Sources


MIKRON
M300 SERIES
Blackbody Radiation Calibration Sources From -20 C to 3000 C traceable to NIST

Mikron's blackbody radiation calibration sources, for IR thermometers, radiometers, heat flux meters, thermal imaging systems and spectrographic analyzers, are available for –20 to +3000 °C, traceable to NIST. Our catalog describes 14 models: compact, portable units; a dual-cavity model for calibration of two temperature points between measurements; and fixed-temperature freezing point of metal sources.

Mikron Infrared Inc. **Circle No. 56**

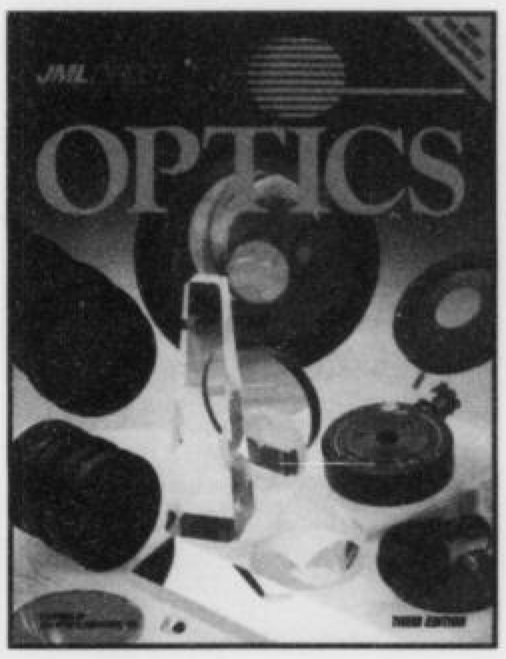
High-Voltage Power Supplies

2004 PRODUCT CATALOG
1-800-9HV POWER
www.ultravolt.com

UltraVolt's catalog covers more than 400 models of high-voltage power supplies, including output short-circuit and arc protection; TTL enable/disable; ultralow ripple to <3 mV; analog programmable and DAC ready; modular or rack mount; and DC/DC and universal AC input. Output voltages are available from 0 to 62 V through 0 to 40 kV at 4 through 250 W.

UltraVolt Inc. **Circle No. 75**

Free Precision Optics Catalog



JML's third-edition catalog offers thousands of off-the-shelf precision optics. Products include lenses, prisms, cylinders, mirrors, multielement systems, aspheres and irises. Antireflective and reflective dielectric and metallic coatings also are available from JML. Also offered are custom design and manufacturing of OEM lenses.

JML Direct Optics **Circle No. 76**

Infrared Optics Catalog

This 110-page catalog is a must for everyone working in the IR. It features windows, lenses, domes and prisms, as well as filters, polarizers, beamsplitters and micro-optics. Optical materials include CaF_2, ZnSe, Ge, BaF_2, MgF_2, LiF, KRS-5, KBr, KCl, NaCl, CdTe, GaAs, ZnS, sapphire, crystal quartz, fused silica and more.

ISP Optics **Circle No. 77**

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Updated Web Site

fiberguide industries
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Fiberguide Industries Inc., a provider of fiber optic solutions to OEMs for more than 25 years, introduces its improved comprehensive Web site with emphasis on capabilities, technological expertise, applications and our latest concept in consulting and design services. The updated site, at www.fiberguide.com, includes a company history as well as information about our markets, accomplishments and patents and the commitment we bring to our OEM customers. Detailed product specifications also are included.

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Optical Components Catalog

Order your free new 2005 optical components catalog from Ross Optical Industries, a leading supplier of precision optics. Choose from more than 2000 optical components. If your priorities are on-time delivery of quality optics at competitive prices, this catalog is for you. Use our capabilities in optical design, engineering, prototyping and coating. Whether your requirements are catalog or custom, "Optics by Ross" is for you.

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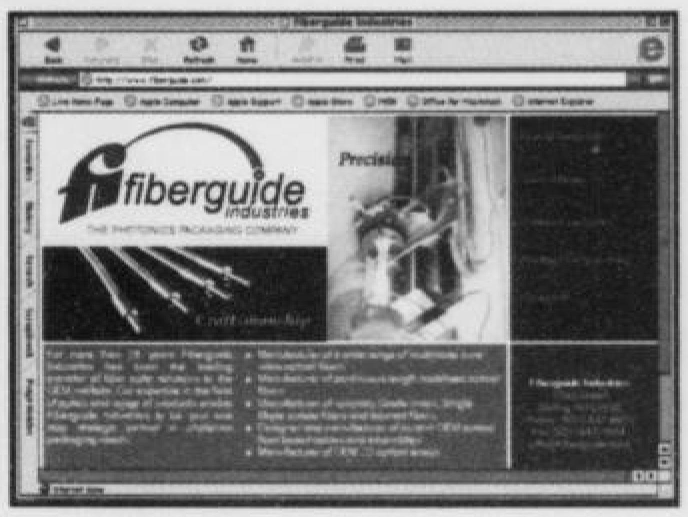

Fiberguide Industries Inc., a provider of fiber optic solutions to OEMs for more than 25 years, introduces its improved comprehensive Web site with emphasis on capabilities, technological expertise, applications and our latest concept in consulting and design services. The updated site, at www.fiberguide.com, includes a company history as well as information about our markets, accomplishments and patents and the commitment we bring to our OEM customers. Detailed product specifications also are included.
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Optical Components Catalog

Order your free new 2005 optical components catalog from Ross Optical Industries, a leading supplier of precision optics. Choose from more than 2000 optical components. If your priorities are on-time delivery of quality optics at competitive prices, this catalog is for you. Use our capabilities in optical design, engineering, prototyping and coating. Whether your requirements are catalog or custom, "Optics by Ross" is for you.
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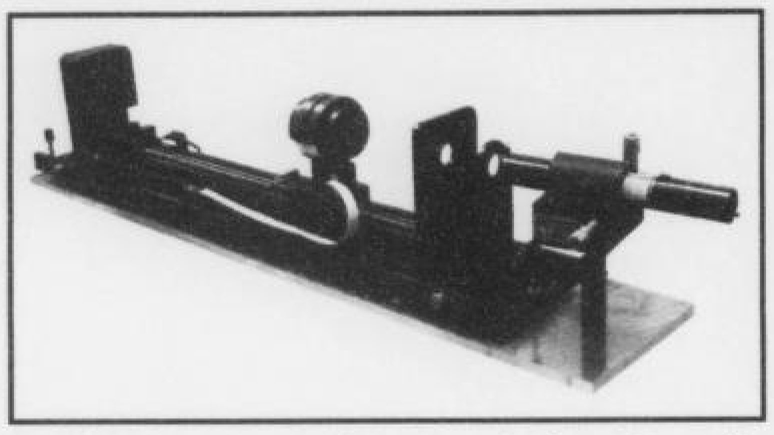
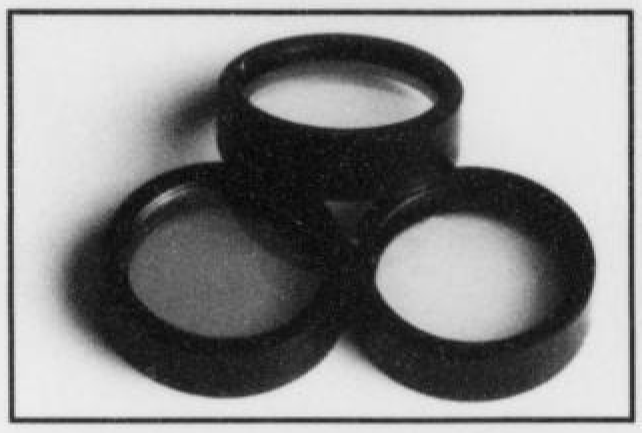
New ModeScan Capabilities



Photon Inc. has added the NanoScan to its ModeScan ISO-compliant M^2 instrument to expand the range of lasers that can be measured. Designed to operate in the production environment, ModeScan reports beam waist location, diameter, divergence and M^2 propagation factor in a matter of seconds.

Photon Inc. **Circle No. 79**

Laser-Line Bandpass Filters



For applications that require laser wavelengths without spontaneous emission noise, these high-performance ion-beam-sputtered filters are robust and provide very narrow passbands at laser wavelengths. Ideal for fluorescence instrumentation, Raman spectroscopy, and analytical and medical laser systems, the filters transmit more than 90% at the laser wavelength but offer blocking of more than 5.0 OD at just ±1% of the laser wavelength. Available wavelengths are from 363.8 to 1064 nm.

Edmund Industrial Optics **Circle No. 80**

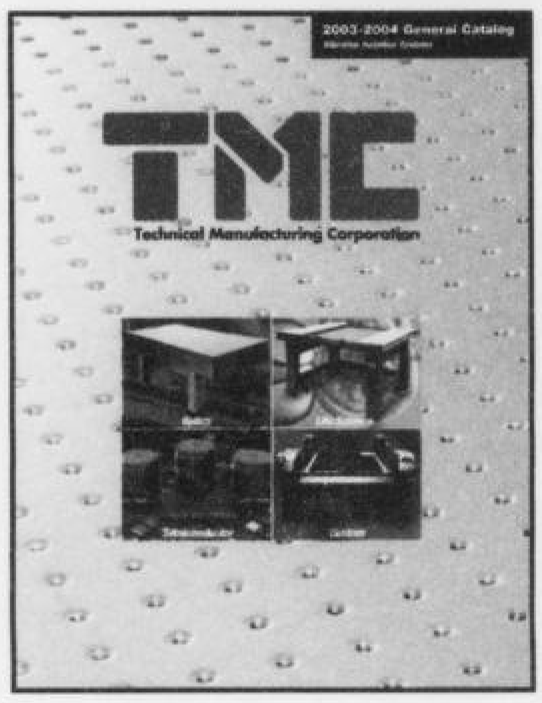
Measurement and Automation Catalog

The Measurement and Automation Catalog 2005

The 2005 Measurement and Automation Catalog from National Instruments features new product information, comparison charts, key specifications and related Web links, including the NI LabView 7.1 graphical development environment; SignalExpress interactive measurement software; M series multifunction DAQ devices and USB DAQ portable devices; high-performance PXI controllers; 200-MS/s modular instruments; and reconfigurable real-time control and acquisition systems.

National Instruments **Circle No. 81**

Vibration Solutions


2003-2004 General Catalog
TMC
Technical Manufacturing Corporation

TMC's 120-page General Catalog presents its full line of vibration isolation systems and equipment. Highlights include the patented CleanTop™ II steel honeycomb optical top and the patented STACIS® active piezoelectric vibration cancellation system. Cleanroom-compatible, nonmagnetic and breadboard versions of the tops are described. Standard and custom tables and accessories are available. A detailed technical background section includes a vibration tutorial.

Technical Mfg. Corporation
Circle No. 82

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